BOARD OF LAND AND NATURAL RESOURCES

STATE OF HAWAI‘I

| | |
|---|---|
| In the Matter of Conservation District Use Application for<br><br>UNIVERSITY OF HAWAI‘I INSTITUTE FOR ASTRONOMY<br><br>to construct and operate six 1.8-meter Outrigger Telescopes (CDUP application HA-3065) within the summit area of the Mauna Kea Science Reserve, District of Hāmākua, Island of Hawai‘i | DLNR File No. HA-02-06<br><br>BOARD OF LAND AND NATURAL RESOURCES' FINDINGS OF FACT, CONCLUSIONS OF LAW, AND DECISION AND ORDER; CERTIFICATE OF SERVICE |

**BOARD OF LAND AND NATURAL RESOURCES' FINDINGS OF FACT, CONCLUSIONS OF LAW AND DECISION AND ORDER**

## FINDINGS OF FACT

### I. INTRODUCTION

1. This contested case hearing involves Applicant University of Hawai‘i Institute for Astronomy's ("UH IfA") Conservation District Use Application ("CDUA"), dated October 24, 2001. The application is for a Conservation District Use Permit ("CDUP") to construct six 1.8-meter (72-inch) Outrigger Telescopes, appurtenant structures and associated infrastructure in the Conservation District atop Mauna Kea. Exhibit A19.

#### A. Parties

2. The University of Hawai‘i ("University" or "UH") was established as the state university and constituted a body corporate. (Haw. Rev. Stat. § 304-2). The Institute for Astronomy is the major astronomical research organization of the University of Hawai‘i.

3. Petitioner Sierra Club, Hawai‘i Chapter ("Sierra Club") is a nonprofit Hawai‘i environmental organization.

4. Petitioner Clarence Ching ("Ching") is a Hawaiian cultural practitioner.

5. Petitioner Harry Fergerstrom ("Fergerstrom") is a Hawaiian cultural practitioner.

6. Petitioner Royal Order of Kamehameha I ("ROOK I") is an organization. Paul Neves, a member of ROOK I, is a Hawaiian cultural practitioner.

7. Petitioner Mauna Kea Anaina Hou ("MKAH") is an organization. Kealoha Pisciotta, a member of MKAH, is a Hawaiian cultural practitioner.

8. Intervenor Hawaii Island Economic Development Board ("HIEDB") is a nonprofit corporation formed in 1983.

## B. Procedural History of the Contested Case Hearing

9. UH IfA published the draft Environmental Assessment for the Outrigger Telescopes Project in March 1999. McLaren WDT at 16 [1].

10. UH IfA published its Final Environmental Assessment ("EA") and Finding of No Significant Impact for the Keck Outriggers Project in March 2002, in fulfillment of the State Chapter 343 requirements. McLaren WDT at 16-17; Exhibit A25.

11. UH IfA submitted its CDUA for the Outrigger Telescopes Project to the Department of Land and Natural Resources ("DLNR") on October 24, 2001. McLaren WDT at 17; Exhibit A19.

12. Public hearings on UH IfA's CDUA were held on March 20, 2001 and March 21, 2002. Before the close of the public hearing, oral requests for a contested case hearing on the CDUA were made by Petitioners Sierra Club, Ching, Fergerstrom, ROOK I and MKAH. UH IfA participated in the public hearings. McLaren WDT at 17.

13. Written requests for a contested case hearing on the CDUA were made by Petitioners Sierra Club, Ching, Fergerstrom, ROOK I and MKAH.

### 1. Appointment of Hearing Officer

14. Minute Order No. 1, dated May 20, 2002, allowed comments or objections on the appointment of the Honorable Boyd P. Mossman as Contested Case Hearing Officer.

15. On July 23, 2002, the Honorable Boyd P. Mossman recused himself due to a potential conflict of interest. Minute Order No. 4

16. Minute Order No. 4, dated August 7, 2002, allowed comments on the appointment of Dawn N.S. Chang as Contested Case Hearing Officer. UH IfA submitted its "Objections to Proposed Hearing Officer" dated August 21, 2002.

17. As stated in Minute Order No. 7, dated August 28, 2002, Dawn N.S. Chang withdrew as hearing officer.

---

[1] Written testimony of the various witnesses will be referred to by the last name of the witness, followed by "WDT" for written direct testimony ("WRT") for written rebuttal testimony, as may be appropriate, followed by the page number of the testimony.

18. Minute Order No. 7, dated August 28, 2002, allowed comments on the appointment of Michael Gibson as Contested Case Hearing Officer. MKAH and Ching objected to the appointment of Michael Gibson as hearing officer.

19. Pursuant to Minute Order No. 8, dated September 6, 2002, the Chairperson treated MKAH and Ching's objections to the appointment of Michael Gibson as hearing officer as motions to disqualify the appointed hearing officer. The Chairperson denied the motions, finding that MKAH and Ching failed to state a sufficient basis for disqualification.

**2. Standing**

20. Nine Petitions to participate in the contested case proceedings were filed, including: Sierra Club, Hawai'i Chapter; Clarence Ching; Anakura Melemai and Harold Jim; KAHEA: the Hawaiian Environmental Alliance; 'Ilio'ulaokalani Coalition[2]; ROOK I; Harry Fergerstrom; MKAH; and Hawaii Island Economic Development Board.

21. On July 19, 2002, UH IfA submitted its Motion to Deny Petitions, or in the Alternative, to Limit the Number of Parties to the Contested Case Hearing ("Motion to Deny").

22. On September 8, 2002, MKAH and ROOK I submitted a Joint Memorandum in Opposition to the UH IfA's Motion to Deny. On September 9, 2002, Sierra Club submitted its reply to the UH IfA's Motion to Deny, and Ching submitted a Memorandum in Opposition to UH IfA's Motion to Deny.

23. Pursuant to Minute Order No. 5, dated August 8, 2002, a prehearing conference on standing was held on September 17, 2002. UH IfA, Sierra Club, Ching, Anakura Melemai, ROOK I, Fergerstrom, MKAH and HIEDB appeared at the September 17, 2002 hearing.

24. On October 7, 2002, the hearing officer recommended that the following petitions be denied: (1) KAHEA: The Hawaiian Environmental Alliance; (2) 'Ilio'ulaokalani Coalition; and (3) Anakura Melemai and Harold Jim.

25. On October 11, 2002, the Board of Land and Natural Resources entered its order denying the petitions for participation in this contested case filed by (1) KAHEA: The Hawaiian Environmental Alliance; (2) 'Ilio'ulaokalani Coalition; and (3) Anakura Melemai and Harold Jim.

**3. Site Visits**

26. On October 9, 2002, ROOK I filed its Site Visit Proposed Protocol.

27. On October 11, 2002, UH IfA filed its Recommendation for Site Visit Protocol.

---

[2] 'Ilio'ulaokalani Coalition is referred to variously throughout transcripts, orders and pleadings as "'Iioulaokalani Coalition," "'Io'ulaokalani Coalition" and as "'Ilio'ulaokalani Coalition." For consistency, it is referred to herein as "'Ilio'ulaokalani Coalition."

28. On October 28, 2002, the Hearing Officer filed Minute Order No. 11 regarding the scheduling and protocol for the site visit.

29. On November 15, 2002, Sierra Club submitted its Memorandum on Recommended Observations on Mauna Kea Site Visit.

30. On November 18, 2002, MKAH submitted its Memorandum Regarding the Mauna Kea Site Visit; Petitioners Recommended Observations for the Mauna Kea Site Visit, and UH IfA filed its Site Visit Narrative.

31. On November 19, 2002, UH IfA filed its Supplemental Statement Regarding Site Visit.

32. On November 20, 2002, the first site visit was conducted.

33. On December 6, 2002, MKAH, ROOK I and Sierra Club submitted their Joint Memorandum Regarding Observations from the Mauna Kea Site Visit and Recommendations for the Next Site Visit/Inspection.

34. On December 16, 2002, the Hearing Officer filed Minute Order Number 17 (Re: Second Site Visit), which scheduled a second site visit.

35. On December 30, 2002, UH IfA filed its Memorandum Regarding Site Visits and Request for Clarification of Minute Order No. 17 (Re: Second Site Visit).

36. On January 5, 2003, MKAH, Ching and Sierra Club submitted a Joint Memorandum in Opposition to the University's Memorandum Regarding Site Visits and Request of Clarification of Minute Order No. 17 (Re: Second Site Visit).

37. On January 6, 2003, the Hearing Officer filed Minute Order Number 19 (Re: Clarification of Minute Order Number 17), which clarified the scheduling and protocol for the second site visit.

38. On January 14, 2003, Sierra Club submitted its Memorandum on 1/15/03 Site Visit.

39. On January 15, 2003, the second site visit was conducted.

### 4. Prehearing Conference Statements

40. UH IfA submitted its Prehearing Conference Statement on July 22, 2002. UH IfA submitted its Second Prehearing Conference Statement on September 3, 2002.

41. Sierra Club filed its "Prehearing Conference #1 Statement" on July 22, 2002.

42. HIEDB submitted its Prehearing Conference Statement dated July 22, 2002.

43. Ching submitted his Prehearing Conference Statement dated August 22, 2002. Ching also submitted his "Amended Petitioner's Prehearing Conference Statement" dated September 3, 2002.

44. MKAH submitted two undated Prehearing Conference Statements.

45. ROOK I submitted Prehearing Conference Statements dated July 22, 2002 and August 31, 2002.

46. Pursuant to Minute Order No. 10, Fergerstrom was ordered to file a Prehearing Conference Statement no later than noon, October 31, 2002.

47. Fergerstrom submitted a prehearing conference statement dated November 19, 2002.

48. The contested case hearing commenced on February 10, 2003, and testimony was taken during eight hearing days: February 10, 11, 12, 13, 24, 25 and April 3 and 9, 2003.

### C. Motions

#### 1. Melemai/Jim Motion to Stay

49. On September 3, 2002, Anakura Melemai and, Harold Uhane Jim submitted their Motion to Stay Pending Investigation by United States for Breach of Trust.

50. Ms. Melemai and Mr. Jim were not granted standing as parties in this matter. Therefore, their motion was not considered.

#### 2. UH IfA's Motion to Establish Scope of Hearing

51. On October 11, 2002 UH IfA filed its Prehearing Motion to Limit Issues and Establish Scope of Hearing.

52. On November 1, 2002 Sierra Club submitted its Objection to the University's Prehearing Motion to Limit Issues and Establish Scope of Hearing.

53. On November 1, 2002, MKAH and ROOK I submitted their Joint Memorandum in Opposition to the University's Pre-Hearing Motion to Limit Issues and Establish Scope of Hearing.

54. On November 6, 2002, UH IfA filed its Supplemental Memorandum in Support of its Pre-Hearing Motion to Limit Issues and Establish Scope of Hearing.

55. On November 15, 2002, the Hearing Officer filed Minute Order No. 13 (Re: Issues), which defined the issues to be addressed in this contested case, and established the burden of proof on those issues.

### 3. First Motion to Dismiss

56. On October 11, 2002, Ching filed his Motion to Dismiss the University's Conservation District Use Application, or in the Alternative, to Mandatorily [sic] Join All Real Parties in Interest on the Conservation District Use Application ("First Motion to Dismiss").

57. On November 1, 2002, Sierra Club submitted its Memorandum in Support of the First Motion to Dismiss.

58. On November 1, 2002, UH IfA filed its Memorandum in Opposition to the First Motion to Dismiss.

59. On November 12, 2002, Ching submitted his Response to the University's Memorandum in Opposition to the First Motion to Dismiss.

60. On November 18, 2002, the Hearing Officer filed Minute Order No. 15 (Re: Clarence Ching's Motion), denying the First Motion to Dismiss.

### 4. Motion to Deny or Continue

61. On February 7, 2003, MKAH submitted its Motion to Deny or Continue the University's Conservation District Use Permit Application, based on the argument that an approved management plan for the Outrigger Telescopes project was lacking ("Motion to Deny or Continue").

62. On February 10, 2003, UH IfA served its Memorandum in Opposition to the Motion to Deny or Continue, arguing that the University had complied with the obligation to submit an approved management plan with its application.

63. On February 27, 2003, the Hearing Officer filed Minute Order Number 25 (Re: Management Plan), which ordered that the contested case hearing continue on April 3, 2003 on the issue of whether the University's Management Plan, attached as Appendix E to the Conservation District Use Application Form (Exhibit A19), should be approved.

### 5. Second Motion to Dismiss

64. On March 17, 2003, MKAH, ROOK I, Sierra Club and Ching submitted a Motion to Dismiss or Re-Notice and Continue the University's Conservation District Use Permit Application ("Second Motion to Dismiss").

65. On April 1, 2003, UH IfA filed its Memorandum in Opposition to the Second Motion to Dismiss.

66. On April 9, 2003, the Hearing Officer filed Minute Order Number 28 (Re: Mauna Kea Anaina Hou, Royal Order of Kamehameha I, Sierra Club, Clarence Ching's Motion to Dismiss or Re-Notice and Continue the University of Hawaii Institute for Astronomy's Conservation District Use Application), which denied the Second Motion to Dismiss.

### 6. Fergerstrom's Motions

67. On October 30, 2002, Fergerstrom filed his Motion in Limine; Motion to Remove Hearing Officer; Request for Production of Maps (1886-7) Kingdom Map Division of Ahupua'a; Judicial Notice ("Fergerstrom's Motions"), which objected in part to the appointment of Michael W. Gibson as the hearing officer in this case.

68. On November 12, 2002, UH IfA filed its Memorandum in Opposition to Fergerstrom's Motions.

69. On November 15, 2002, the Hearing Officer filed Minute Order No. 14 (Re: Fergerstrom's Motions), denying Mr. Fergerstrom's motion in limine and request for production of maps The motion for removal of the hearing officer was referred to the Chairperson of the Board of Land and Natural Resources.

70. On November 18, 2002, the Chairperson of the Board of Land and Natural Resources denied Fergerstrom's Motion to Disqualify the Hearing Officer by written order.

### 7. Petitioners' Motion for Subpoena

71. On October 11, 2002, MKAH and ROOK I submitted their Joint Motion for the Issuance of a Subpoena for the Production of Documents or Records ("Motion for Issuance of a Subpoena").

72. On October 29, 2002, UH IfA filed its Memorandum in Opposition to the Motion for the Issuance of a Subpoena.

73. On October 31, 2002, the Hearing Officer filed Minute Order Number 12, which ordered the University to provide to MKAH and ROOK I, jointly, certain documents.

74. On November 13, 2002, MKAH submitted its Supplemental Memorandum in Support of the Motion for the Issuance of a Subpoena.

75. On November 18, 2002, the Hearing Officer filed Minute Order No. 16 (Re: Request for a Subpoena), which ordered the University to produce certain documents. The University was ordered to produce three copies of the documents: one copy to MKAH and ROOK I, a second copy to Sierra Club, Hawaii Chapter, and the third copy to the Department of Land and Natural Resources.

76. On December 20, 2002, UH IfA filed its Motion for Reconsideration of Minute Order No. 16 (Re: Request for Subpoena) requesting modification of the scope of documents it had been ordered to produce.

77. On January 3, 2002, the Hearing Officer filed Minute Order Number 18 (Reconsideration of Minute Order 16), denying the University's Motion for Reconsideration.

78. UH IfA produced documents responsive to Minute Order 16 on December 6, 2002, January 8, 2003, January 10, 2003, January 13, 2003, January 17, 2003, January 21,

2003, January 27, 2003, February 13, 2003 and February 24, 2003. The University produced 10,372 pages of documents in response to Minute Order 16.

### 8. Motions Requesting Extensions of Time

79. On January 5, 2003, MKAH, ROOK I and Sierra Club submitted a Joint Motion Requesting Extension of Time for Submittal of Petitioners' Witness Lists, Witness Testimonies and Exhibits ("First Motion Requesting Extension of Time").

80. On January 10, 2003, UH IfA filed its Memorandum in Opposition to the First Motion Requesting Extension of Time.

81. On January 14, 2003, the Hearing Officer filed Minute Order No. 20, allowing MKAH and ROOK I to file certain supplemental witness lists, witness statements and exhibits no later than January 31, 2003.

82. On January 23, 2003, MKAH submitted its Motion to Reconsider Minute Order No. 20 (Re: Petitioners Supplemental Witness Lists, Witness Statements and Exhibits).

83. On January 27, 2003, UH IfA filed its Memorandum in Opposition to MKAH's Motion to Reconsider Minute Order 20 (Re: Petitioners' Supplemental Witness Lists, Witness Statements and Exhibits).

84. On January 29, 2003, the Hearing Officer filed Minute Order No. 22 (Re: MKAH's Motion to Reconsider Minute Order No. 20), which allowed MKAH and ROOK I to file certain supplemental witness lists, witness statements and exhibits no later than February 6, 2003.

### 9. MKAH's Motion to Compel

85. On January 23, 2003, MKAH submitted its Motion to Compel the University and Tom Nance to Produce List of References as Cited.

86. On January 27, 2003, UH IfA provided to MKAH twelve of the sixteen documents requested by MKAH.

87. On January 27, 2003, UH IfA filed its Memorandum in Opposition to Petitioner Mauna Kea Anaina Hou's Motion to Compel the University and Mr. Tom Nance to Produce List of References as Cited.

88. On January 29, 2003, the Hearing Officer filed Minute Order No. 23 (Re MKAH's Motion to Compel), which ordered the University to provide an aerial topographic map to MKAH.

### 10. UH IfA's Motions to Exclude Testimony and Exhibits

89. On February 4, 2003, UH IfA filed its Motion to Exclude Testimony and Exhibits, which sought to exclude certain testimony and exhibits due to Petitioners' failure to comply with the deadlines and other requirements in Minute Order 9.

90. On February 6, 2003, MKAH submitted its Memorandum in Opposition to the University's Motion to Exclude Testimony and Exhibits.

91. On February 8, 2003, Sierra Club submitted its Memorandum in Opposition to the University's Motion to Exclude Dr. Howarth's Testimony from Hearing.

92. On March 24, 2003, UH IfA submitted its Motion to Exclude Testimony pursuant to Minute Order 25 (Re: Management Plan), which argued that testimony submitted by Petitioners regarding the management plan should be excluded because either Petitioners (1) failed to present written testimony as required by Minute Order 25; (2) presented evidence which was unnecessarily cumulative; (3) presented evidence on legal conclusions; or (4) presented testimony which was not pertinent to the Outrigger Telescopes Management Plan.

### 11. MKAH's Request for Clarification

93. On February 6, 2003, MKAH submitted a Request for Clarification Regarding Scheduling and Logistics which requested a telephone line and speaker phone for the presentation of Petitioners' evidence

94. On February 7, 2003, UH IfA filed its Memorandum in Opposition to Petitioner MKAH's Request for Clarification Regarding Scheduling and Logistics.

### 12. Post-Hearing Motion

95. Due to disputes relating to the copying of official transcripts of the contested case, on May 17, 2003, the Hearing Officer issued Minute Order 29 extending the filing period for the Petitioners to provide proposed Findings of Fact and Conclusions of Law until May 23, 2003.

## II. UH IFA'S PROPOSED PROJECT

### A. Project Description

96. There are two telescopes on the William M. Keck Observatory ("WMKO") site. Construction of Keck I commenced in 1985 with the leveling of the WMKO site. The University of Hawai'i was granted a Conservation District Use Permit (CDUP HA-1646) for Keck I in l984. Subsequently, the Keck II telescope (CDUP HA-2509, 1991) and a carport (Site Plan Approval, 1997) were constructed on the site. McLaren WDT at 16, Exhibit A19 at 16.

97. A complex optical system is proposed to combine the light received simultaneously by various combinations of the Outrigger Telescopes and the Keck Telescopes

to create a high resolution synthesized image. The Outrigger Telescopes will be a permanent addition to the WMKO. Chaffee WDT at 6.

98. The CDUA for the Outrigger Telescopes, Exhibit A19, does not request subdivision approval, and UH does not intend to request or utilize subdivision of land as part of this project. McLaren WDT at 24.

99. As proposed, each of the six Outrigger Telescope will consist of a 1.8 meter (6 foot) diameter, f/1.5 primary mirror, a secondary mirror, a tertiary mirror, a dual star module and a starlight beam on the telescope yoke. A dome, measuring 9.1 meters (30 feet) in diameter at its widest point and 8 meters (26 feet) in diameter at its base, will enclose each telescope to protect it from the harsh conditions on Mauna Kea. Each dome will be large enough to accommodate both a telescope and a dual star module and have a slit width adequate for unobstructed viewing with a 1.8 meter (6 foot) diameter primary mirror. The proposed domes would stand 10.7 meters (35 feet) high as measured from the top of the level grade at elevation 4,146 meters (13,603 feet). By comparison, each of the Keck domes is 37 meters (121 feet) in diameter at its widest point and 33.9 meters (111 feet) high. Chaffee WDT at 6; Bell WDT at 6, Exhibit A19 at 29; Exhibit A25 at Bates Stamp 3970.

100. The dome enclosures will be made up of two sections: a cylindrical lower ring wall base, 7.9 m (26 ft.) in diameter, fixed-in-place, made of corrugated metal, painted "heritage red" to blend into the surrounding landscape, and, an upper, white 9.1-m (30-ft.) diameter (at its widest point) spherical fiberglass dome which would rotate along the top of the ring wall on 16 wheels. Bell WDT at 6, Exhibit A19 at 29; Exhibit A25 at Bates Stamp 4000, 4002.

101. The proposed Outrigger Telescopes will be strategically placed around the 10-meter (33 -foot) Keck I and Keck II Telescopes currently being operated by California Association for Research in Astronomy ("CARA"). The proposed Outrigger Telescopes will be built on the plateau created to construct the Keck Telescopes. Chaffee WDT at 7; Bell WDT at 6; Brenner Tr. 2/12/03 at 124:8-12.[3]

102. The locations of the Outrigger Telescopes were chosen to meet the project scientific goals and to minimize impacts upon the Wēkiu Bug. The facilities for the Outrigger Telescopes Project include the Outrigger Telescopes, dome enclosures, and underground pipes and structures. Bell WDT at 5; Exhibit A19 at 27. The final design will not differ significantly from what was stated in the CDUA and the EA. Some specifications – for example, pipe sizes – are under review and may change slightly in the final design. As required, final grading and construction plans will be submitted to the DLNR for approval before County of Hawai'i permits are obtained. Bell WDT at 5; Exhibit A19 at 29.

103. Each proposed telescope and dome will be mounted on separate concrete foundations for the purpose of vibration isolation. The domes will be large enough to

---

[3] Oral testimony of the various witnesses will be referred to by the last name of the witness, followed by "Tr." for transcript, the date of the testimony, followed by the page and line number of the testimony.

accommodate both a telescope and a dual star module and have a slit width adequate for unobstructed viewing of the sky with a 1.8-m (6-ft.) diameter primary mirror. Bell WDT at 6; Exhibit A19 at 29.

104. Each of the proposed telescopes will be supported by an underground telescope instrument room, which will act as a telescope pier. The mirrors that inject the starlight beams into the underground light pipes would be housed in this underground telescope room. Five new junction boxes (JB-3, JB-4, JB-5, JB-6 and JB-7) will be constructed. Bell WDT at 6; Chaffee WDT at 6; Exhibit A19 at 29; Exhibit A25 at Bates Stamp 4002-03.

105. Each junction box will house mirrors that redirect the starlight beams through underground light pipes to the basement of the Keck Telescope building, where the interferometer instrumentation would be located. Access to JB-3 and JB-6 will be through the South tunnel and North tunnel, respectively. An above-grade roof hatch colored "heritage red" to blend into the surrounding landscape will provide access to the inside of JB-2, JB-4, JB-5, and JB-7. The hatches will be marked appropriately with snow poles to provide a route for snowplows. Bell WDT at 7; Chaffee WDT at 6; Exhibit A19 at 29; Exhibit A25 at Bates Stamp 4003.

106. Light pipes serve as conduits for the light beams between the proposed Outrigger Telescopes and the basement instrumentation room in the main WMKO facility. Light pipes located on the north side of the facility will serve as light conduits for Outrigger Telescopes 1, 2, 5 and 6 to JB-6. From there, a 1.5- by 2.4-m (5- by 8-ft.) North tunnel will serve to bring starlight beams into the basement instrumentation room in the main WMKO facility. The pipes will be buried in trenches. Bell WDT at 8; Exhibit A19 at 29; Exhibit A25 at Bates Stamp 4003.

107. Two existing 1.2-m (4-ft.) air pipes may have to be reinstalled 0.6 m (2 ft.) deeper if they interfere with the light pipes. The 88.7 m (291 ft.) long light pipe between JB-5 and JB-6 will be routed under the service road. It will either be installed in a culvert, in a trench covered by cinder or by some other method that will ensure that the pipe will not be damaged by vehicular traffic. The existing 2.4 m (8 ft.) wide by 2.1 m (7 ft.) high by 20 m (67 ft.) long (interior dimensions) underground tunnel on the south side of the facility and a proposed new junction box (JB-3) will provide a path for the starlight beams from Outrigger Telescopes 3 and 4 and would provide personnel access to JB-3. This tunnel already exists. Bell WDT at 8-9; Exhibit A25 at 4003.

108. The light path from Outrigger Telescope 4 will be via an existing 36-inch (3-ft.) light pipe from JB-2 to the South tunnel; the light path for Outrigger Telescope 3 will be via JB-3, which will be attached to the end of the tunnel. JB-1 and JB-2 were constructed in conjunction with the Temporary Optical Test Sites (TOTS) project. They will be retained and used to route the beams from Outrigger Telescope 4 into the existing South tunnel. Bell WDT at 9; Exhibit A19 at 29, 37; Exhibit A25 at Bates Stamp 4003-04.

109. Smaller pipes, to be installed in the same trenches as the light pipes, will be used to route power and communication signals from the control room in the Keck

basement to the Outrigger underground telescope instrument rooms and junction boxes. Exhibit A19 at 37; Exhibit A25 at Bates Stamp 4004; Bell WDT at 9.

110. Air pipes (up to 24-inch-diameter) will be installed to exhaust warm air away from the Outrigger Telescopes in order to minimize turbulence that could be created by plumes of warm air rising up in front of the telescope optics. The warm air, which is caused by heat from the electronics and motors within the enclosures, could significantly degrade the images formed by the telescopes. With the exception of Outrigger Telescope 2, the air pipes will be routed underground to the edge of the slope as follows: north about 18.3 m (60 ft.) for Outrigger Telescope 1, north about 15.2 m (50 ft.) for Outrigger Telescope 5, northwest about 15.2 m (50 ft.) for Outrigger Telescope 6, south about 7.6 m (25 ft.) for Outrigger Telescope 3, and north about 7.6 m (25 ft.) for Outrigger Telescope 4. Bell WDT at 9; Exhibit A19 at 37; Exhibit A25 at 4004-05.

111. The air pipe for Outrigger Telescope 2 is planned to run above ground about 4.6 m (15 ft.); its end will be mounted on the top of the retaining wall adjacent to JB-5. A square pad (1.2- to 1.8-m (4- to 6-ft.)) of either pre-cast concrete or hardened-in-place cinder will be installed at the end of each pipe. Bell WDT at 9; Exhibit A19 at 37.

112. The placement of up to six signs on the WKMO site is within the parameters of Haw. Admin. Rules § 13-5-22, "P-8 Signs". The signs will inform visitors of the cultural significance of the crater and the need to protect the Wēkiu bug. The signs' design will be submitted to both the DLNR and the Office of Mauna Kea Management ("OMKM") for approval prior to installation. McLaren WDT at 23; Exhibit A19 at 10, 37-38.

113. The signs will be located on the WMKO site, primarily along the Puʻu Hau ʻOki crater rim. One of the approved signs will be placed near the access point to Puʻu Hau ʻOki crater to protect the Wēkiu Bug habitat restoration area. Bell WDT at 12; Exhibit A25 at Bates Stamp 4010.

114. Design of the signs will be consistent with the guidelines presented in the recently adopted Mauna Kea Science Reserve Master Plan, Exhibit A10, in that they will be small and unobtrusive and printed in black, blue, or dark earth tones. The signs will conform with criteria specified in Haw. Admin. Rules 13-5-22, that is: they will be no larger than 1.1 square m ($m^2$) (12 square ft. ($ft^2$)) in area; they will not be lighted; they will be erected to be self-supporting; and, they will be no higher than 2.4 m (8 ft.) above finished grade. Bell WDT at 12; Exhibit A25 at Bates Stamp 4010.

115. Two areas adjacent to Outrigger Telescopes 1 and 2 (up to 0.09 acres total) will be used for basic data collection, research, education and resource evaluation. The areas will be used to provide restored Wēkiu bug habitat, replacing habitat disturbed during Outrigger Telescopes construction. A similar restoration proposal, within the Puʻu Hau ʻOki crater floor, was approved by DLNR on October 31, 2000. There will be periodic monitoring of the habitat restoration areas throughout the construction period and for five years following construction of the Outrigger Telescopes. This data collection is allowed pursuant to Haw. Admin. Rules §13-5-22 (P-1 Data Collection). McLaren WDT at 23; Exhibit A19 at 6, 10.

## B. Site Construction Activities

116. On-site construction work for the Outrigger Telescopes Project will start as soon as practical after all permits have been obtained. It is expected that the site work for all six telescopes and the installation and commissioning of the first four telescopes and their dome enclosures will be completed approximately 16 months after the project starts. The remaining two telescopes and their enclosures are not funded at this time. After their funding is secured, it will require an additional six months to install and commission them. Bell WDT at 11; Exhibit A19 at 38; Exhibit A25 at Bates Stamp 4005. If the two phases of construction do not occur within three months of each other all facilities, containers and equipment used during the first phase will be removed from the site and all approved staging areas until commencement of the second phase of construction.

117. Until funding of Outrigger Telescope 5 and 6 is secured, concrete work for those two telescopes will be limited to structures that are no higher than 19 cm (7 inches) above level ground. For reasons of safety, the unfinished underground telescope instrument rooms will be covered with steel plates and the area secured. Each telescope foundation area, including the 18-cm (7-inches) high ring wall footing and covered telescope instrument room, will then be covered with cinder from project excavations. It was determined that there would be less negative impact on the site if all the underground work for all six telescopes were done during a single construction period. Bell WDT at 11; Exhibit A19 at 38; Exhibit A25 at Bates Stamp 4005.

118. Prior to undertaking underground work in the vicinity of power and communications cables, the contractor will install sheet piling as required by the Hawaii Electric Light Company (HELCO). This will protect the cables from inadvertent disturbance by construction equipment. The sheet piles will be removed and transported off the mountain when this phase of the on-site construction is finished. Bell WDT at 11; Exhibit A25 at Bates Stamp 4005.

119. About 918 cubic meters ($m^3$) (1,200 cubic yards ($yd^3$)) of cinder will be excavated to install about 274 m (900 ft.) of light pipe and air pipe trenches. About 1,835 $m^3$ (2,400 $yd^3$) of cinder will be excavated for telescope footings and underground telescope instrument rooms. Approximately 50 percent of the excavated material will be replaced on top of the tunnels and pipes and used for backfill around the telescopes. Excavated material not required for fill will be graded, and suitably sized cinder will be washed and used for restoration of the Wēkiu Bug habitat. Any excavated cinder not used for backfill or restoration would be placed on the mountain at locations determined after consultation with the State Historic Preservation Division ("SHPD") and OMKM. Bell WDT at 11-12; Exhibit A25 at Bates Stamp 4005.

120. The approximate total amount of concrete needed for the tunnel, junction boxes, dome, and telescope foundations is estimated to be about 512 $m^3$ (670 $yd^3$). Concrete will be ready-mixed in Hilo or Waimea and delivered to the site by truck. Wherever possible, CARA plans to use pre-cast concrete for the junction boxes and telescope foundations. Bell WDT at 12.

121. Some equipment will be fabricated offsite and transported to Mauna Kea. The dome enclosure sections (ring wall base and spherical dome), telescopes, vacuum light pipes, the smaller junction boxes and retained formwork for the telescope piers will be prefabricated off-site and shipped to either Hilo or Kawaihae harbor in standard marine 12-m (40-ft.) by 2-m (8-ft.) containers. From there, the containers will be transported to an approved construction staging area approved by OMKM or to the WKMO site, off-loaded and unpacked. The components will then be delivered to the project site on flatbed trucks if they are not delivered directly to the project site. Bell WDT at 12-13; Exhibit A19 at 51; Exhibit A25 at Bates Stamp 4010, 4014.

122. The components of each Outrigger Telescope will be packed in up to ten plywood boxes and shipped to Hawai‘i (Kawaihae or Hilo) on standard marine 12-m (40-ft.) by 2-m (8-ft.) open flat racks. These racks will be delivered to the approved staging area, off-loaded and unpacked. Flatbed trucks will then bring the telescope components to the WMKO site. Bell WDT at 13; Exhibit A19 at 51; Exhibit A25 at Bates Stamp 4014.

123. After each enclosure is erected, its telescope will be assembled on the previously constructed concrete pier. Large components will be lifted with a crane and placed in the enclosure through the enclosure shutter. When complete, the final large component - the dual star module - will be hoisted through the dome shutter and installed on the telescope. Bell WDT at 13; Exhibit A19 at 51; Exhibit A 25 at Bates Stamp 4010.

124. The following facilities and equipment will be temporarily on site: A trailer to be used as a temporary office for construction management may be on site throughout the construction period. It is estimated that at various times during on-site construction - not necessarily at the same time - two excavators, a grader or bulldozer, two water trucks, two back-hoes, a loader, two or three dump trucks, a forklift, three or four cement trucks, two or three flatbed trucks, a crane of approximately 64-mt (70-ton) capacity, a compactor, and a vibrating hammer rig may also be present on site. Bell WDT at 13; Exhibit A25 at Bates Stamp 4014.

125. During on-site construction, a total of twenty 2- by 12-m (8- by 40-ft.) containers, painted brown or green, may be present at the summit or at the approved staging area at one time. Materials and equipment stored in these containers will be unloaded at the approved staging area and transported to the WMKO site. In addition, two or three flatbed trucks with cranes and two or three forklifts will be located at the approved staging area to support these activities. Bell WDT at 13; Exhibit A25 at Bates Stamp 4014.

126. If possible, all twenty containers will be unloaded at the WMKO site. If it is not feasible to store twenty containers at the summit, it will be necessary to unload some of them at the approved staging area. Bell WDT at 13-14; Exhibit A25 at Bates Stamp 4014.

127. If unloading does take place at the approved staging area, up to ten containers, a forklift and one or two flatbed trucks will be present on the site to support these activities. Bell WDT at 14; Exhibit A25 at Bates Stamp 4014.

128. Underground site work will require a maximum of 15 construction workers for approximately 9 months; a maximum of 12 workers will be required for about 17 months to assemble and test the enclosures and telescopes. Construction times may vary because of unfavorable weather conditions. Because enclosure erection and telescope installation will begin as soon as the site work for each telescope is completed, the site work crew and the enclosure/telescope erection crews will be on site at the same time for about three months of the construction period. Construction workers will either commute from off-mountain locations or use existing facilities at the Hale Pōhaku Construction Camp. Workers involved in dome assembly and telescope installation will most likely stay at Hale Pōhaku. Bell WDT at 14; Exhibit A19 at 51; Exhibit A25 at Bates Stamp 4014.

## III. BACKGROUND

### A. Leases and Subleases

129. The proposed site is located within the Astronomy Precinct at the summit area of the Mauna Kea Science Reserve. Chaffee WDT at 7; Exhibit A25 at Bates Stamp 3989.

130. In 1968, the State of Hawai‘i by its Board of Land and Natural Resources ("BLNR"), entered into a lease with the University of Hawai‘i for the Mauna Kea Science Reserve (General Lease No. S-4191). Exhibit A1.

131. The Mauna Kea Science Reserve was established for use as a scientific complex. Originally, the Mauna Kea Science Reserve was 13,321.054 acres. On March 23, 1998, BLNR and UH agreed to withdraw two parcels of land totaling 2,033.2 acres from the Mauna Kea Science Reserve. This property became part of the Mauna Kea Ice Age Natural Area Reserve ("NAR") and remains under the jurisdiction of the Department of Land and Natural Resources. The Keanākako‘i adze quarry, Lake Waiau, Pu‘u Waiau, Pu‘u Haukea and Pu‘u Pōhaku are within the NAR area. McLaren WDT at 3; Chaffee WDT at 7; Exhibit A25 at p. I-7; Exhibit A1 at Bates Stamp 00011-00015.

132. The University has entered into scientific partnership agreements with various organizations to develop and use observatory facilities on Mauna Kea. As a part of these agreements, UH has subleased parcels of the Science Reserve to those organizations. Twelve telescope facilities are in operation in the summit area. These include: eight major optical/infrared telescopes, one 0.6 meter telescope, two single-dish millimeter/submillimeter-wavelength telescopes, and a submillimeter array. The Very Long Baseline Array (VLBA) Antenna Facility is situated at the 12,200 foot elevation of the Reserve. All of the telescopes are used for basic astronomical research to study objects in our galaxy and other galaxies. A list of the Mauna Kea Observatories, the participants and the year the observatory became operational can be found in Exhibit A25, Appendix A at p. 76. McLaren WDT at 3-4; Chaffee WDT at 7.

133. The five acre WMKO site (the "WMKO site") is subleased to the California Institute of Technology ("Caltech"). The construction of the WMKO was funded, in

large part, by grants from the W. M. Keck Foundation. It is operated by the California Association for Research in Astronomy ("CARA"), a non-profit corporation established by Caltech and the University of California. The BLNR consented to the sublease of property to Caltech on June 14, 1985. McLaren WDT at 4; Chaffee WDT at 7; Exhibit A2.

134. The summit of Mauna Kea is within the ahupua'a of Ka'ohe, as confirmed by the kama'aina testimonies from native speakers who participated in the Boundary Commission proceedings from 1873 to 1891. Maly Tr. 2/13/03 106:9-107:23.

### B. Operating and Site Development Agreement

135. UH, Caltech and The Regents of the University of California ("UC") entered into an Operating and Site Development Agreement, ("OSDA"). The OSDA was renegotiated in June 1992 in anticipation of the construction of the Keck II telescope. The OSDA delineates the roles and responsibilities of the parties. The sublease is an attachment to the OSDA. McLaren WDT at 4; Exhibit A40.

136. Caltech and UC agree in the OSDA to "conform to applicable regulations established by the University of Hawai'i, by the State of Hawai'i, and by the United States of America for the preservation of the environmental quality and the scientific integrity of the Mauna Kea Science Reserve." Exhibit A40 at 6. Thus, where the State of Hawai'i may seek corrective action or sanctions against the University of Hawai'i for the violation of any permit condition, the University, in turn, has a means of recourse against the facility. McLaren WDT at 5; Exhibit A40 at p 6.

137. Within the OSDAs for Mauna Kea summit facilities, UH IfA's partners agree to comply with the University's regulations, state regulations and federal regulations. Kudritzki Tr. 2/10/03 at 102:5-9.

138. In light of the concerns expressed with regard to compliance, the University is considering stronger and more specific language in future OSDAs and OSDA amendments, beginning with the amendment of the Keck OSDA to incorporate the Outrigger Telescopes. McLaren WDT at 5-6.

139. The OSDA between UH IfA, UC, and Caltech for the Keck Observatory is fundamentally a scientific partnership agreement and is similar in form and content to the OSDAs that UH IfA has with the other observatory organizations. The basic agreement is that UH IfA provides the use of the site by means of the sublease, which is an attachment to the OSDA. UH IfA also assists with the planning and permitting of the facility, develops and manages the common infrastructure on the mountain, and protects the Science Reserve from such things as radio frequency interference and light pollution. The observatory organization is responsible for constructing the facility, for making a contribution to further infrastructure development, and for funding the operations. The partners share the product of the collaborative effort--namely the observing time. UH IfA typically receives 10-15 percent of the observing time in return for its contributions to the partnership. McLaren WDT at 6-7.

140. UH shall not sell or transfer outside UH control any of the observing time that it obtains under any of its agreements with observatories. There is no unutilized telescope

viewing time. Observing time is available to all qualified UH scientists and is awarded competitively twice a year with proposals evaluated by peer review. In the case of Keck, the time is oversubscribed typically by a factor of at least two. McLaren WRT at 5-6.

### C. CARA and the WMKO

141. Made possible through grants totaling more than $140 million from the W.M. Keck Foundation, the Keck Observatory is operated by CARA. The Keck I telescope began science observations in May, 1993; Keck II began in October, 1996. Chaffee WDT at 2.

142. CARA is a not-for-profit corporation formed to oversee the operation of the Keck Observatory. Besides the Keck Observatory at the summit, CARA has a headquarters facility in Waimea. Of its 120 employees, 6 are Ph.D. astronomers. CARA's annual expenses approximate $17 million. Chaffee WDT at 1.

143. About 300 astronomers observe at WMKO annually, primarily from UC, Caltech, and University of Hawai'i but also from such institutions as The University of Texas, Planetary Sciences Institute, Northern Arizona University, Carnegie Institution of Washington, Goddard Spaceflight Center, Lowell Observatory, State University of New York, and Institute of Astronomy (Cambridge, UK) Chaffee WDT at 2.

144. The Keck telescopes operate primarily as independent telescopes. Approximately 10% of the time they are used together as an interferometer. This is driven by demand, and may change in the future. Chaffee WDT at 2.

145. The twin Keck telescopes are the world's most powerful optical and infrared telescopes. At the heart of each Keck telescope is a primary mirror. Ten meters in diameter (394 inches), the mirror is composed of 36 hexagonal segments that work in concert as a single piece of reflective glass. Chaffee WDT at 2.

146. The Keck telescopes are used by astrophysicists to seek answers to questions: How, and when, did galaxies form? What is the rate of star formation in galaxies far away, and far back in time? How do solar systems form? How many planets orbit nearby stars? What is dark matter? What is the ultimate fate of the Universe? In the past few years, astronomers at Keck have made tremendous progress in their search to find answers to these and other questions. Chaffee WDT at 2-3.

147. Keck's major technological advancements are centered on the use and development of computer technology for astronomical observations. These observations include discoveries of planets orbiting nearby stars and to identifying the most distant galaxies in the Universe. Chaffee WDT at 3.

148. In the last 7 years, about 100 new planets have been discovered. Astronomers using the Keck telescopes discovered about 75% of these.

## D. The Technique of Interferometry

149. Astronomy is basic science and concentrates on the scientific exploration of the universe. Astronomy has changed our understanding of the world and our thinking as humans. The telescopes on Mauna Kea and Haleakala have contributed fundamentally to the advancement of modern astronomy. Kudritzki WDT at 8.

150. Using a new observational technology called interferometry, the Outrigger Telescopes Project ("OTP") will allow astronomers to study objects in the universe in much higher detail than before. Kudritzki WDT at 8.

151. Interferometry is the technique of combining light or radio waves from two or more telescopes. Beichman WDT at 4; Beichman Tr. 2/10/03 at 165:21-166:6.

152. Adding the Outrigger Telescopes to Keck I and Keck II will provide two new capabilities. The Outrigger Telescopes will enable very high angular resolution images by allowing observations to be made along many baseline orientations instead of just the single Keck I- Keck II baseline. They will also be able to measure the positions of stars with very high accuracy. Beichman WDT at 5-6; Beichman Tr. 2/10/03 at 166:10-25.

153. The Outrigger Telescopes will provide images as if there were a telescope the size of a full football field, without having to build such a telescope. Beichman Tr. 2/10/03 at 174:10-25.

## E. Mauna Kea Environment

154. Mauna Kea is unique in the world for astronomical research for two reasons. The first reason is Mauna Kea's high altitude which means that most of the time the summit is above the inversion layer and free of clouds, and that the water column density above the mountain is very low which is important for modern astronomy. The second reason, which is even more important, is Mauna Kea's isolated location in the middle of the Pacific. The atmospheric wind stream comes smoothly over the ocean and the first obstacle that it hits is the summit of the mountain. As a result the atmosphere above the summit is extremely stable, and the sharpest images of the sky taken on earth are taken on Mauna Kea. Kudritzki Tr. 2/10/03 at 99:13-100:17.

155. In addition, the County of Hawai‘i has a strong island-wide lighting ordinance to ensure an extremely dark sky, allowing observation of the faintest galaxies that lie on the edge of our observable Universe. Chaffee WDT at 8.

## F. Benefits of Astronomy

156. UH does not sell or otherwise receive compensation for any of the OSDA-prescribed observing time. UH does receive funds for three distinct purposes under the terms of the OSDA. First, each new observatory is required to contribute to the continued development of the Mauna Kea infrastructure. To date Caltech and UC have contributed a total of about $3.8 million, almost all of which went to road paving, the installation of fiber-optics communications, and the development of the new Mauna Kea Science Reserve Master

Plan. Second, each observatory is required to pay its share of the operating expenses of Mauna Kea Observatories Support Services, which operates on a break-even basis. Third, under the terms of the sublease, each observatory pays a "rental charge" of $1 per year. McLaren WDT at 8.

157. As a result of access to observing time at Keck, and similar access to the other Mauna Kea Observatories, the UH IfA has developed into one of the world's preeminent centers for astronomical research, with the ability to attract the best faculty and best students from around the world. McLaren WDT at 8; Chu WDT at 3.

158. The University of Hawai'i is the only institution in the United States which allows students to be Principal Investigators for research projects at the new generation of extremely large telescopes such as the Kecks, Subaru and Gemini. No other school, including Caltech and the University of California (which jointly run the Keck telescopes), affords that opportunity to their students. This offers students the opportunity to acquire valuable research experience and skills very early in their careers. Kudritzki WDT at 3.

159. Astronomy facilities on Mauna Kea and Haleakala represent a capital investment of close to $1 billion. The economic impact of astronomy to the State amounts to $140 million per year. Kudritzki WDT at 6; Chu WDT at 3.

160. The proposed expansion of the Keck facility itself is a $50 million project. Chu WDT at 3.

161. The astronomy industry contributes approximately $40 million annually to the Big Island economy. It provides employment opportunities for island residents and businesses. Chu WDT at 3.

162. The observatories and other astronomy-related activities on Mauna Kea and Haleakala provide 500 quality jobs in a clean high-tech industry on the neighbor islands. It is important to note that only a small fraction of these jobs are for astronomers. Most of them are for technical, administrative and logistic services. Beyond the simple numbers, there is the fact that astronomy as a high-tech science diversifies the Hawai'i economy and gives young local people with scientific and technical talents a wealth of opportunities to realize their potential without having to leave their family and friends in Hawai'i to pursue employment elsewhere. Unlike some high-tech industries, astronomy is fundamentally rooted in Hawai'i. It cannot be relocated to the mainland or overseas. Kudritzki WDT at 6.

### G. <u>The 2000 Master Plan</u>

163. In 1983, the University of Hawai'i adopted the Mauna Kea Science Reserve Complex Development Plan (CDP). The CDP projected development up to the year 2000 and it contained a Management Plan, which was accepted by the Board of Land and Natural Resources as CDUP HA-1573. McLaren WDT at 9.

164. The University of Hawai'i Board of Regents approved the Mauna Kea Science Reserve Master Plan in June 2000 ("2000 Master Plan"). The 2000 Master Plan was never adopted nor approved by BLNR. In the 2000 Master Plan, the University concluded that

there was a need for a single entity to manage the comprehensive plan for the Mauna Kea Science Reserve. The 2000 Master Plan calls for the management organization to be housed within the UH system and funded as an ongoing program unit of the University of Hawai‘i at Hilo ("UH-Hilo"). In accordance with the 2000 Master Plan, UH-Hilo Chancellor Rose Tseng established the Office of Mauna Kea Management ("OMKM") on August 1, 2000. Stormont WDT at 2; Kudritzki Tr. 2/10/03 at 121:19-22; McLaren WDT at 15.

165. OMKM is the University office charged with ensuring compliance with and implementation of the 2000 Master Plan. Stormont WDT at 1; Kudritzki Tr. 2/10/03 at 130:9-13.

166. OMKM's objectives are summarized in its Mission Statement:

> Achieve harmony, balance and trust in the sustainable management and stewardship of the Mauna Kea Science Reserve through community involvement and programs that protect, preserve and enhance the natural, cultural and recreational resources of Mauna Kea while providing a world-class center dedicated to education, research and astronomy.

Stormont WDT at 2.

167. The 2000 Master Plan sought to include community involvement in the management of the Science Reserve and recommended a management board "composed of members representing the major stakeholders of Mauna Kea." (Exhibit A10 at p. X-7 ). In fulfillment of this recommendation, the Mauna Kea Management Board ("MKMB") was established. The MKMB is comprised of seven members appointed by the UH Board of Regents. Stormont WDT at 2.

168. A special group, the Kahu Ku Mauna Council (Guardians of the Mountain), is appointed by the Mauna Kea Management Board to serve as advisors to the OMKM and MKMB on all matters impacting the cultural integrity of Mauna Kea. Stormont WDT at 3.

## H. Project Design Pursuant to the 2000 Master Plan

169. The 2000 Master Plan established a project approval and design process to ensure that future projects in the Science Reserve conform to and implement the concepts, themes and development standards and guidelines set forth in the 2000 Master Plan. The University Board of Regents and President retain project approval and design review authority over all developments in the Science Reserve. To assist the University in its evaluation, all applications are reviewed by OMKM, MKMB and Kahu Ku Mauna. OMKM and MKMB review the plans for overall conformance to the Master Plan. Stormont WDT at 8.

170. The 2000 Master Plan also requires the establishment of a Design Review Committee ("DRC") comprised of, but not limited to, professionals in the field of architecture, landscape architecture and engineering. The goals of the design guidelines are contained in Chapter XI of the 2000 Master Plan, Exhibit A10. Stormont WDT at 8.

171. Projects are also reviewed at the Chancellor level. Thus, after OMKM and MKMB review a project, the Chancellor of UH-Hilo will also review it. If the project is initiated by the University of Hawai‘i Institute for Astronomy, the project will also be reviewed by the Chancellor of UH-Manoa. Stormont WDT at 8.

172. Finally, the 2000 Master Plan also created separate processes for "Major Projects" and "Minor Projects." Minor Project review ends with the Office of the President. Major Projects require final approval by the Board of Regents. Stormont WDT at 8.

173. The Outrigger Telescopes Project has been classified as a Major Project. A letter written by Rolf-Peter Kudritzki to Judge Walter Heen, the interim director of OMKM, initiated the process. Judge Heen responded on July 10, 2001. He indicated that the matter would be presented to the Mauna Kea Management Board with the recommendation that the project be classified as a Major Project. Exhibit A17; Kudritzki WDT at 12; Stormont WDT at 8.

174. Subsequently, the Mauna Kea Management Board recommended that the project be classified as "major." UH Hilo Chancellor Rose Tseng forwarded this recommendation to UH President Evan Dobelle. In August 2001, President Dobelle approved the recommendation, and consequently, the Outrigger Telescopes Project has been designated a "Major Project" in accordance with the Master Plan. Exhibit A18; Kudritzki WDT at 12; Stormont Tr. 2/12/03 at 182:7-10.

175. The Design Review process for the Outrigger Telescopes Project has started. There are four phases of the Design Review process for a major project: (1) Pre-Design Meeting; (2) Schematic Design; (3) Design Development; and (4) Construction Documents Review. The Outrigger Telescopes Project has gone through two of the four phases. A pre-design meeting has been held and a schematic design review was done. Thus far, the Outrigger Telescopes Project has been found to be in compliance with the 2000 Master Plan. Stormont WDT at 9; Stormont Tr. 2/12/03 at 182:10-19; Bell Tr. 2/11/03 at 8:16-20.

## I. Construction Control Measures

176. Except as they may conflict with permit conditions, the proposed Outrigger Telescopes Project site construction will be controlled by the following documents: (1) Memorandum of Agreement Under the National Historic Preservation Act, Exhibit A24; (2) Construction Best Management Practices Plan, Exhibit A25 at Bates Stamp 4166-4183; (3) Wēkiu Bug Mitigation Plan, Exhibit A25 at Bates Stamp 4154-4162; (4) Project Manual; (5) Archaeological Monitoring Plan; and (6) Cultural Monitoring Plan. Each of these documents will be attached to the site works contract as a condition of performance for the contractor. Bell WDT at 3-5.

177. In order to mitigate impacts to the cinder slopes below the WMKO complex and restore habitat for the Wēkiu Bug, the Wēkiu Bug Mitigation Plan was created based on recommendations from Pacific Analytics, a natural resources consultant. The plan specifies certain practices to follow during construction and operation. It also specifies how to

restore bug habitat. Bell WDT at 4. There will be an entomologist as part of the project team. Bell. Tr. 2/11/03 at 30:20-21 and 36:14-16.

178. The CARA Construction Manager, in cooperation with CARA, the contractor and OMKM, will prepare a Project Manual which will incorporate the finalized "Construction Best Management Practices Plan" ("BMP"); specific emergency response plans for injuries, medical emergencies, and fire; other standard practices such as CARA's safety manual; and protocols for Wēkiu Bug and cultural mitigation. CARA, OMKM, and the General Contractor will approve this manual. Bell WDT at 4.

179. The contractor will be required to follow the approved BMP during all on-site construction and installation activities per the site work contract. Bell WDT at 15.

180. It is one of the CARA construction manager's primary responsibilities to ensure that the contractor complies with all aspects of the contract, including the BMP. Bell WDT at 15; Bell Tr. 2/11/03 at 30:5-10.

## IV. PROJECT SITE

### A. Existing Structural Features

181. The above grade facilities at WMKO consist of two domes, each housing a Keck ten-meter telescope with supporting facilities and work spaces located between the domes. The footprint of the existing WMKO facility is approximately 43,320 sq. ft. Each dome is 9,700 sq. ft.; the support building is 20,500 sq. ft.; and the lower mechanical room is 3,420 sq. ft. The lower mechanical room height matches the existing grade of the Kecks at 13,603 ft. The floor of the mechanical room is at 13,588-ft. elevation and the foundation is 2.5 ft. below grade. The dome enclosures are 111 ft. in height and 121 ft. in diameter. The support building height is 17 ft. 6 in. Bell WDT at 1-2.

182. The foundations of the WMKO facility extend to various depths with the deepest being 18 ft. below grade, occupying a footprint of approximately 49,400 sq. ft. The occupied spaces below grade extend to a depth of 11.5 ft. and are within a footprint of 7215 sq. ft. Bell WDT at 2.

183. Existing additional underground equipment at the WMKO site include exhaust air pipes, utility infrastructure, and miscellaneous accessory facilities. The exhaust air pipes plan area is approximately 4,360 sq. ft. and the Verizon/HELCO utility infrastructure plan area is approximately 3,500 sq. ft. Figure 1 to the testimony of James Bell is a plan diagram showing the existing facilities. Bell WDT at 2.

184. The WMKO site consists of a total of approximately 5 acres. Approximately 2.8 acres was leveled during construction of the Keck I and Keck II telescopes. The six Outrigger Telescopes will be placed at strategic locations around the two Keck Telescopes within the previously disturbed site. Bell WDT at 10; Brenner Tr. 2/12/03 at 124:8-12; Exhibit A44 and A45.

185. The elevation of Puʻu Hau ʻOki prior to the construction of Keck I and Keck II was approximately 13,638 feet. The elevation is now approximately 13,600 feet. Bell WDT at 10; Exhibit A44 and A45; Bell Tr. 2/10/03 at 209:5-6 and 210:20-211:7.

186. The WMKO site was first leveled in 1985 in preparation for the construction of the Keck I Telescope (CDUP HA-1646, 1984). Subsequently, the Keck II Telescope (CDUP HA-2509, 1991) and a carport (Site Plan Approval, 1997) were constructed on the site. The Keck II Telescope was built adjacent to the Keck I Telescope on a portion of the area that was leveled during the first telescope's construction. Exhibit A19 at 16.

187. The plateau on which Keck I and Keck II now sit is no longer suitable long-term habitat for Wēkiu bugs. Howarth Tr. 2/24/03 at 65:2-16.

188. Dr. Howarth delineated a wedge shaped area of very good Wēkiu bug habitat at Puʻu Hau ʻOki crater. Howarth Tr. 2/24/03 at 64:21-65:1; Exhibit A42 (pink highlighting). This area will not be disturbed by the construction of the Outrigger Telescopes. Exhibit A42.

189. The grading and filling of the crater conformed to the grading plan approved by DLNR. The grading plan showed Puʻu Hau ʻOki crater being used as a fill site. Exhibit 7 to Stone WDT at 2; and Exhibit 8 to Stone WDT at 1.

### B. Coastal Zone Management Area

190. In a letter dated February 25, 2002, the County of Hawaiʻi, Planning Department advised the University that the areas involved in the Outrigger Telescopes project are not in the County's Special Management Area (SMA) and are not subject to the regulatory review or requirements of the Hawaiʻi County Planning Commission's SMA Rule 9. Exhibit A41; McLaren WDT at 23.

### C. Alternatives to the Proposed Project

191. Ten alternative sites, both inside and outside the United States, were considered. All of the site alternatives, along with the Proposed Action, were evaluated on the basis of two tiers of screening criteria. The Tier 1 screening criteria included: (1) one or more existing large telescopes on the site; (2) adequate relatively level land available to provide sufficient baselines for imaging and astrometry; and (3) site observing quality. The Tier 2 screening criteria included: (1) maximizing sky coverage; and (2) programmatic feasibility (e.g., need to modify existing facilities or add adaptive optics, incremental program costs). Exhibit A25 at Bates Stamp 3898, and 4017-20.

192. The Tier 1 and Tier 2 screening criteria were applied to alternative sites in Las Campanas, Chile; Cerro Paránal, Chile; Cerro Pachon, Chile; Mt. Graham, Arizona; Anderson Mesa, Arizona; Mt. Hopkins, Arizona; Palomar Mountain, California; Mt. Wilson, California; and Mauna Kea (Gemini North and Subaru), Hawaiʻi. Exhibit A25 at Bates Stamp 4020-4026.

193. None of the alternative sites was determined to have all of the attributes considered necessary for achieving all of the scientific objectives established for the Outrigger Telescopes Project. Beichman Tr. 2/10/03 at 177:24-178:22; Exhibit A25 at Bates Stamp 3898.

194. Under the No-Action Alternative, the Outrigger Telescopes Project would not be constructed as WMKO and the Keck Interferometer would consist of only the existing two 10-meter telescopes. The proposed project area would continue to be used for parking, vehicle turn-around and other such uses. Although the potential environmental impacts described in the Final EA would not occur, No-Action also means that the interferometer would be able to achieve only two of its six scientific objectives. Exhibit A25 at Bates Stamp 3898, 3900 and 4017.

195. Also under the No-Action Alternative, NASA's funding for the Wēkiu Bug on-site mitigation, the autecology study, and the Wēkiu Bug monitoring activities would not occur. NASA's funding for the on-site and off-site mitigation activities proposed by NASA in the Section 106 process also would not occur. Exhibit A25 at Bates Stamp 4017.

## V. VISUAL IMPACTS

196. The summit of Mauna Kea is visible from a large area of the island of Hawai'i. Visibility, measured by computer analysis in 1983, indicated that many telescopes constructed on the summit are visible from locations as distant as Hilo and Waimea. On top of cinder cones, views of the sky are obstructed by man-made features on the mountain. Views of Haleakala can be obstructed from the summit cones by telescopes. Neves Tr. 2/25/03 138 at 19-25; Exhibit F-30.

197. The proposed Outrigger Telescopes will be visible "from most locations in the summit area." Bell WDT at 16; Exhibit A25 at p I-10.

198. Although the proposed Outrigger Telescopes will not be visible from the City of Hilo, they would be able to be seen from other sections of the island. McLaren Tr. 2/13/03 13:11-13; Exhibit A25 at p I-10;.

199. The rotating domes will be white unless OMKM Design Review Committee recommends a different color. The metal-clad ring walls will be "heritage red" - a color chosen to blend with the existing natural surfaces unless OMKM recommends a different color. Bell WDT at 16; Exhibit A25 at p. I-10.

200. The white color for the rotating domes mitigates their visual impacts, since the white hemispherical dome is seen against, and dwarfed by, the larger Keck domes. McLaren Tr. 2/13/03, 13:5-6 and 13:13-20.

201. OMKM's design guidelines require projects to consider approaches that would make facilities that are in clear view less visible. OMKM Design Review Committee shall have authority to impose conditions to minimize visual impacts. McLaren Tr. 2/13/03 at 12:1-21.

202. The concrete used in the construction of the retaining walls will be color-matched to the surrounding cinders. Proper design and grading practices – such as using natural materials obtained from the project site for fill and surfacing – will minimize the visual impact. The areas surrounding the Outriggers Telescopes will remain in natural cinder, as is the current practice at the WMKO site. Bell WDT at 16; Exhibit A25 at p I-10.

203. The visual impact of the Outrigger Telescopes will be minimal. Bell WDT at 16.

## VI. WASTEWATER, CHEMICAL USE, HYDROLOGY

### A. Wastewater

204. Tom Nance was qualified as an expert in hydrology. Nance Tr. 2/11/03 at 213:3-7. Brad Finney was not qualified as an expert in hydrology. Brad Finney was qualified as an expert in environmental engineering. Finney Tr. 2/13/03 at 233:17-20 and 244:7-9. Tom Nance was more credible than Brad Finney. Reliable and probative evidence supports Tom Nance's opinions and recommendations.

205. The Outrigger Telescopes Project will not have an adverse impact on Lake Waiau, springs or groundwater. Nance Tr. 2/13/03 at 14:14-23.

206. Sewage disposal and treatment at WMKO is handled by a single septic/leach-field system that serves the WMKO facility, which includes both Keck I, and Keck II. All sinks and toilets at the WMKO facility drain into the cesspool and septic/leach-field system. There is no plan for construction of a sanitary sewer collection system to serve the summit area. Hazardous waste liquids are not disposed of in sinks or other receptacles that drain into the seepage pool and septic system. Laub WDT at 1.

207. WMKO wastewater is disposed of by means of a 4-k1 (1,000-gal) septic tank and a 17-k1 (4,500-gal) seepage pit, which operates in the same manner as a leach-field. Wastewater enters the two-stage septic tank where bacteria digest bio-solids that settle to the bottom of the tank. The liquid component of the wastewater then flows from the septic tank into a 6-m (20-ft) deep seepage pit that drains into subsurface cinder. Laub WDT at 1.

208. The solid matter or sludge that settles to the bottom of the tank is pumped out periodically and disposed of at an approved waste treatment plant. Laub WDT at 1.

209. The State Department of Health approved the WMKO wastewater collection and disposal system. Exhibit A56 is a copy of the May 19, 1994 permit from the Hawai'i Department of Health. Laub WDT at 2.

210. The planned Outrigger Telescopes Project is anticipated to increase the wastewater discharge by 2500 gallons per month (about 80 gallons per day). Laub Tr. 2/11/03 at 141: 16-21; Exh A25 at Bates Stamp 4076. Laub WDT at 5. The wastewater system at the WMKO will be able to accommodate the additional 2,500 gallons per month of wastewater. Laub WDT at 5.

211. To assess the impact of the increased wastewater discharge of 2,500 gallons per month from the Outrigger Telescopes Project, Mr. Nance researched the current level of wastewater discharge, reviewed plans of the septic tank and disposal pit system, and did a "worst case" dilution calculation to quantify the potential impact on wells which draw water from the flanks of Mauna Kea. Nance WDT at 4.

212. Based on discussions with Keck personnel and Mr. Nance's own observations at WMKO, liquids discharged into this wastewater treatment and disposal system are limited to domestic wastewater. Washwater from mirror washing which used to be discharged into this system are now put into containers and transported off the mountain for proper treatment and disposal elsewhere. To approximate the current amount of domestic wastewater generated, Mr. Nance assumed that all water trucked to the site for potable use becomes wastewater. In the latter half of 2002, this averaged 650 GPD. The additional 80 GPD for personnel for the Outrigger Telescopes Project would be a 12 percent increase. Nance WDT at 4.

213. Based on the assumptions made in Mr. Nance's "worst case" dilution calculation, the computed additions due to wastewater at the nearest wells to Mauna Kea's summit, Waikiʻi Well Nos. 1 and 2 (State Nos. 5239-01 and 02), are: Total Nitrogen 0.003 to 0.007 MG/L; and Total Phosphorus 0.0014 to 0.0027 MG/L. Nance WDT at 5. This calculation entails a series of improbable assumptions – that all wastewater moves toward the Waikiʻi Wells, that none of the wastewater goes in any other direction, and that no nutrient removal would occur by natural processes. Nance WDT at 5; Nance Tr. 2/13/03 at 38:12-39:7.

214. Given the location of WMKO relative to Lake Waiau, subsurface wastewater discharge is not likely to reach or impact the lake. Nance WRT at 3-4; Nance Tr. 2/13/03 at 29:22-24.

215. Subsurface discharges from WMKO are not likely to reach or impact Lake Waiau because the lake is 1.08 miles to the south-southwest and 580 feet lower than WMKO (see Exhibit A60). In the absence of a subsurface perching member, a subsurface discharge could not move a sufficient distance laterally to the lake before dropping more than 580 feet in elevation. In other words, if a subsurface discharge did move laterally toward the lake, it would be below the elevation of the lake by the time it moved over a mile in a southerly direction. Nance WRT at 4; Nance WDT at 3; Nance Tr. 2/12/03 at 202:6-10.

216. Total wastewater production from all ten systems is approximately 1,600 GPD based on the average amount of water delivered to the summit from July to December 2002. Nance WRT at 5.

217. Keck's 390 GPD use is 24% of the total wastewater production from all ten systems. The Outrigger Telescopes project, which is anticipated to generate 80 GPD of wastewater, would be a 5% increase to the total wastewater production at the summit. Nance WRT at 5.

218. Six of the ten systems consist of septic tanks and leach fields. Another two, including WMKO, consist of septic tanks and a disposal pit which represent conversions

from systems, which initially were just cesspools. Finally, two systems are cesspools. Nance WRT at 5.

219. The Hawai‘i Department of Health’s Wastewater Branch regulates wastewater systems and has responsibility for ensuring that discharges from wastewater systems do not contaminate water resources or otherwise pose a health hazard. Nance WRT at 7.

220. All wastewater systems at the summit received permits from the Hawai‘i Department of Health Wastewater Branch. Nance WRT at 7.

**B. <u>Chemical Use</u>**

221. According to the Material Safety Data Sheets (“MSDS”). The University Of Hawai‘i 88 inch or 2.2 meter Observatory (“UH88”) (Exhibit F-64), The Canada-France-Hawaii Telescope (“CFHT”) (Exhibit F-62), The William M. Keck Observatory I and II (“WMKO”) (Exhibit F-61), The NASA Infrared Telescope Facility (“IRTF”) (Exhibit F-60), and The United Kingdom Infrared Telescope used “elemental” mercury(“UKIRT”) (Exhibit F-66).

222. Hazardous materials stored and used at the WMKO include oil, lubricants, ethylene glycol, propylene glycol, hydrofluoric acid, paint and elemental mercury. Laub WDT at 2.

223. Oil is used for the telescope support systems and common lubricating. Lubricants are used for the various gear boxes and drives for the domes. Ethylene glycol is used as a refrigeration cooling medium in instruments in Keck II. Propylene glycol is used as a refrigeration cooling medium in instruments in Keck I. Hydrofluoric acid is used to etch a crack or void in a mirror in order to contain further migration. Paint is used for the maintenance of the facility. Elemental mercury is used only for the Keck I & II f-15 secondary mirror support systems. Laub WDT at 2.

224. CARA has procedures in place for the handling and storage of hazardous materials used at WMKO, including procedures for responding to any accidental releases of such materials. Laub WDT at 2.

225. There have been 3 Mercury spills reported at the William M Keck Telescope. August 10,1995, September 15, 1995, and November 6, 1995. (Exhibit F-49)

226. All used products, which include wastes, generated at the WMKO facility, except domestic wastewater which is disposed of in a septic tank leachfield system, are disposed of off-site at appropriate disposal facilities. Used lubricants, oils, paints, and liquid wash water containing ethylene glycol and propylene glycol are containerized at the WMKO facility. Waste materials and/or used materials generated at WMKO are disposed of at appropriate disposal facilities or are recycled as appropriate. Laub WDT at 2-3; Laub Tr. 2/11/03 at 141:22-142:5.

227. Elemental mercury is used for the lateral restraint on the f/15 secondary mirror on each of the two Keck Telescopes. Elemental mercury will not be used for the Outrigger Telescopes. Laub WDT at 3; Laub Tr. At 2/11/03 at 142:6-8.

228. Operation of the WMKO requires periodic maintenance cleaning, and recoating (re-aluminizing) of the telescope mirror segments and lubrication of the ball bearings throughout the facility. Laub WDT at 4.

229. Periodically, ball bearings throughout the facility are lubricated. During lubrication any excess lubricant is collected and removed to an appropriate waste container. Any lubricant that might be spilled accidentally during the lubrication procedure is cleaned up immediately. All lubricants are of a common industrial variety, and are either liquids (oils) or semisolids (gear lubes or lubricating greases). Laub WDT at 4.

230. The dome for the Keck Telescope has a weather seal. Each seal is a rubber skirt or flap that rides on an aluminum plate. To prevent sticking, in the past, the seal was lubricated with a silicon or graphite lubricant. As a result of the movement of the dome, over time (approximately eight years) lubricant has moved down the wall of the building. As a result, there was an accumulation of lubricant stains on the building walls. However, no lubricant has migrated to the cinder. In addition, the lubricant stains have been removed. Laub WDT at 4.

231. The weather seal on Keck Telescope I has been replaced with a system that does not require lubrication. CARA plans to replace the weather seal for the Keck II Telescope with the same system. Laub WDT at 4-5.

232. The WMKO 10-m (33-ft) mirrors each consist of 36 separate hexagonal mirror segments totaling 72 mirror segments for the Keck I and Keck II Telescopes combined. Mirror cleaning involves monthly use of CO2 to clean the mirrors. Mirror cleaning also consists of occasionally washing several of the mirrors (primarily the secondary and tertiary mirrors) with a soap and water solution. This occurs approximately once every two years for each mirror. Laub WDT at 5.

233. All mirror cleaning and stripping liquids are collected in a contained floor sump within the coating lab. From the sump, the liquid wastes are pumped into 50 gal. Nalgeen drums for storage and ultimately the drums are transported from the summit for disposal. Laub WDT at 5; Bell Tr., 2/11/03, p 59:15-23 and p 66:23-67:13.

234. The operation of the Outrigger Telescopes will require periodic maintenance, cleaning and re-coating (or aluminizing) of the telescope mirrors and lubrication of ball bearings and the dome weather seals. These activities will follow the same procedures described for Keck I and Keck II. Laub WDT at 5.

235. The mechanical elements of the Outrigger Telescopes have ball bearings. The bearings will require periodic lubrication accomplished by injecting lubricant into the bearing. As the new lubricant is injected, the “old” lubricant will seep out of the bearing. The “old” lubricant will be removed by wiping with rags. Laub WDT at 5.

236. The Outrigger Telescope primary mirrors will require cleaning and re-coating in the same manner as the Keck mirror segments. Thus there is an addition of up to 6 Outrigger Telescope mirrors to the existing 72 Keck mirror segments that require cleaning and re-coating. CARA may decide to wash the Outrigger Telescope mirrors once per year using a soap and water solution (no hazardous chemicals) and only re-coat them every 2-3 years, like the Keck mirror segments. The Outrigger Telescopes also contain smaller optics which need to be cleaned periodically and re-coated. Since they are in a more protected environment, re-coating is only required on approximately 4-year intervals. Laub WDT at 6.

237. Rinse water from the cleaning process and rinse water from the aluminum removal process will be collected, removed and transported offsite. It will not enter the wastewater treatment system. Laub WDT at 6.

238. Chemicals are used and stored in areas with concrete floors, which are inside buildings. Chemicals are stored inside leak proof secondary containments. If there is a leak of a stored chemical, it will be retained in its secondary containment.

### C. Hydrology

239. Glacial moraine and meltwater deposits of fine sediments, and glacially sculpted features of cinder cones are evidence of summit glaciation that led to the formation of Lake Waiau, one of the highest lakes in the United States. (F-30 MKSRCDP p 34, 38, 76, 77; A-7 MPMP2000 IV-1)

240. Perennial perched surface water is trapped within the crater of Pu‘u Poliahu and in Lake Waiau located at the 13,020 foot elevation. (F-30 MKSRCDP p 34, 38, 76, 77)

241. Lake Waiau, the highest lake in the Pacific basin, located in the Mauna Kea Ice Age Natural Area Reserve, is approximately 240 feet in diameter and 8 feet deep. In addition to its significance as a geological feature, it is regarded by Hawaiians as a scared place with a rich cultural link to the past. (F-30 MKSRCDP p 34, 38, 76, 77; A-7 MPMP2000 IV-1)

242. The summit has an active hydrologic system, dominated by ephemeral stream flow in response to storm induced precipitation and rapid snow melt, shallow ground water flow and surface emanations as seeps and springs, and the perched water bodies. The subsurface flow from rainfall and snow-melt on the summit is guided downhill by the presence of impermeable substrates, including lava flows, clay layers, and possibly permafrost zones. Except during storms and periods of rapid snowmelt, the pores and cracks within the shallow subsurfaces are not saturated with water except at Lake Waiau. (A-25 BS 4033-4 FEA p 71-2)

243. Activities at the WMKO, including the Outrigger Telescopes project will not adversely affect the quality of water at Lake Waiau. Nance WDT at 1-3; Nance Tr., 2/13/03, p 14:13-23.

244. The first relevant factor which makes it unlikely for surface runoff from WMKO to enter Lake Waiau is that due to the topography of Pu‘u Waiau, only surface runoff from within the crater rim can enter the lake. Based on the USGS quadrangle map (Exhibit

A60) and confirmed by Mr. Nance's field observations and an assessment in Ebel (2001), the contributing watershed is limited to an area of 30 to 35 acres. Nance WDT at 2.

245. The second relevant factor which makes it unlikely for surface runoff from WMKO to enter Lake Waiau is that due to the very high permeability of the leveled gravel area around WMKO, little or no surface runoff ever moves off the site. For example, there is no evidence of rill erosion or other indications of runoff on the rather steep slopes beyond the perimeter of the leveled area of WMKO. Nance WDT at 2; Nance Tr., 2/12/03, p 200:17-201:5 and 2/13/03, p 12:9-13:2.

246. The third relevant factor which makes it unlikely for surface runoff from WMKO to enter Lake Waiau is that in the event that surface runoff during an extreme storm event were to flow off the WMKO site and move in a southerly direction toward Lake Waiau, it would be intercepted by topographic tributaries at the upper end of Pōhakuloa Gulch in the area known as Submillimeter Valley. This path of potential surface runoff is depicted on Exhibits A58 (Figure 3 of Appendix H of the March 2002 Final EA), and A59 (an annotated R.M. Towill topographic map). It is not physically possible for such surface runoff to cross over these features and then flow over the Pu'u Waiau crater rim to enter the lake. Nance WDT at 2; Nance Tr., 2/12/03, p 201:6-25.

## VII. TRADITIONAL, CUSTOMARY, AND RELIGIOUS SITES, PRACTICES, AND USES

### A. Mauna Kea Summit

247. Mauna Kea is the focal point of a number of native Hawaiian traditions, beliefs, customs and practices. With its summit peak reaching 13,796 feet above sea level, Mauna Kea is one of the most significant land features of the Hawaiian Archipelago. In the summit region of Mauna Kea –an area extending from around the 10,000 foot elevation to the summit peak, including a plateau feature above the 11,500 foot elevation - and on its slopes extending down to an area once covered in dense forest growth (approximately the 9,000 foot elevation), are many pu'u (hills) and other natural features. A number of the place names recorded for this mountain landscape are associated with Hawaiian gods. Other place names are descriptive of natural features and resources, or documents events that occurred on the mountain. Maly WDT at 1.

248. As a result of its prominence, isolation, and extreme environmental conditions Mauna Kea's place in the culture and history of the Hawaiian people is significant. This "cultural significance" extends beyond a physical setting, sites or particular features that have been previously identified in archaeological site studies. Mauna Kea is a prominent feature on the cultural landscape of Hawai'i which has been and continues to be viewed from afar, and to which spiritual and cultural significance is attributed. Maly WDT at 3.

249. Wakea and Papa, his wife, are the beginning of the Polynesian Race. Kanahele Tr., 02/12/03, p 49:12-13.

250. "…The upper regions of Mauna Kea reside in Wao Akua, the realm of the Akua-Creator. It is also considered the Temple of the Supreme Being and is acknowledged as

such in many oral and written histories throughout Polynesia, which pre-date modern science by millennia." Exhibit F-5 at 1.

251. The 'top of the mountain was clearly a sacred precinct that must, moreover, have been under a kapu and accessible to only the highest chiefs or priests'." Exhibit A-10 at Bates Stamp 3850.

252. All those that participated in the Oral History interviews which included 22 formal interviews and over 100 informal interviewees [a]ttributed spirituality and healing qualities to being on Mauna Kea; and several recorded that they still go to Mauna Kea for prayer and restoration. One [interviewee] described Mauna Kea as a sanctuary in ancient times. Exhibit A-10 at Bates Stamp 3850.

## B. Designation of Mauna Kea Summit as an Historic Property

253. The cluster of pu'u (cinder cones) forming the Summit of Mauna Kea have been identified by the State Historic Preservation Division ("SHPD") of the Department of Land and Natural Resources ("DLNR") as a Historic Property and the summit region of including most of the Mauna Kea Science Reserve has been identified by SHPD as a Historic District. Both Historic Properties are eligible for listing on the National Historic Register. Exhibit A-10 at Bates Stamp 3856.

254. Within the Historic Preservation domain, a historic district is defined as a historic property that '…possesses a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development.' Exhibit A-10 at Bates Stamp 3856.

255. [P]rovisionally referred to as the 'Mauna Kea Summit Region,' the proposed historic district incorporates virtually the entire Science Research summit area, extending beyond limits of the entire reserve, and also portions of the Natural Area Reserve…The proposed district includes the total of 93 archaeological sites…three landscape features… qualify as traditional cultural properties…the Mauna Kea Adze Quarry Complex…Of the 93 archaeological sites identified to date, 76 are shrines of varying complexity, four are adze manufacturing workshops, one is a confirmed burial, four are possible burials, three are marker cairns, and five are of undetermined function. Exhibit A-10 at Bates Stamp 3856.

256. The largest of the three properties, 'Kukahau'ula refers to the cluster of three pu'u that merge and collectively make up the summit of Mauna Kea…The second property, 'Waiau' refers to the small lake and adjacent pu'u situated southwest of the summit and within the Natural Area Reserve. The third property, Lilinoe, refers to a pu'u situated southeast of the summit and within the Science Reserve. Exhibit A-10 at Bates Stamp 3856.

257. SHPD believes the proposed construction of the six Outrigger Telescopes will have an "adverse effect" on both this historic property and summit region. Exhibit A-25 at Bates Stamp 3929). SHPD stated that the adverse effects could be mitigated if appropriate measures were adopted. McLaren WDT at 18-19; Exhibit A-5

258. The cluster of pu‘u (cinder cones) forming the Summit region is the named Kukahau‘ula. The proposed development area is in this designated historic district and property. Exhibit A-10 at Bates Stamp 3856.

259. Kukahau‘ula is also identified as a “sacred landscape” because the Pu‘u’s (cluster of cinder cones) represent the kinolau (or bodily manifestations) of the Na Akua (the Divine deities). Pisciotta Tr., 02/25/03, p 170-171.

260. Ceremonies were and are still are conducted from the sacred landscape of Kukahau‘ula, which include but are not limited to the marking of the Solstice and Equinox, the marking of the rising and setting of various stars and constellations marking and recording of the Precession (26,000 year cycle of the heavens) or the sacred time and seasons (i.e. Makahiki). Pisciotta Tr., 02/25/03, p 167-171.

261. Within the proposed historic district there is a total of 93 archaeological sites, including three landscape features, one being the Mauna Kea Adze Quarry Complex. Of the 93 archaeological sites identified to date, 76 are shrines of varying complexity, four are adze manufacturing workshops, one is a confirmed burial, four are possible burials, three are marker cairns, and five are of undetermined function.” Exhibit A-10 at Bates Stamp 3856.

### C. Section 106 MOA

262. Since NASA is providing federal funding for this project, Section 106 of the National Historic Preservation Act (“NHPA”) is applicable. NASA consulted with interested parties, including Native Hawaiian groups, in compliance with Section 106. (Exhibit A14, A15, and A23). NASA invited OHA, the Advisory Council on Historic Preservation, SHPD, Hawai‘i Island Burial Council, ROOK I, and Hui Mālama i Nā Kūpuna O Hawai‘i Nei, Ahahui Ku Mauna and MKAH to be consulting parties. NASA also invited OMKM, MKMB and Kahu Ku Mauna to participate in the development of the MOA. McLaren WDT at 19.

263. UH IfA worked closely with NASA in the Section 106 consultation process under the National Historic Preservation Act. UH IfA assisted NASA in making the initial contact and arranging meetings with a number of Native Hawaiian groups. UH IfA was kept fully informed by NASA as the Section 106 process proceeded, and the UH IfA’s Director participated in the final consultation meetings in January 2002. The result of the Section 106 process is the MOA to which UH is a signatory. McLaren WDT at 17; Exhibit A24.

264. ROOK I and MKAH were both invited to attend and participate in formal meetings for the Section 106 consultation process. Exhibit A23.

265. NASA prepared on-site and off-site cultural mitigation measures for consideration by the SHPD, the Advisory Council on Historic Preservation and the other Consulting Parties. These mitigation measures were incorporated into the MOA and made part of the UH EA and the NASA EA. McLaren WDT at 19.

266. The MOA describes steps directed towards preservation and protection of cultural resources. Many of these measures also protect environmental resources. McLaren WDT at 6.

267. The MOA requires that the Construction Manager, contractors, supervisors and all construction workers be trained to become aware of the historic/cultural significance of the project site and surrounding area. A Cultural Monitor will be hired and provided free access during excavation, other on-site construction and telescope installation. McLaren WDT at 20.

268. Proposed grading and site development drawings will be provided to all Consulting Parties and OMKM for a 45-day calendar day review and comment period prior to the commencement of activity that may impact culturally significant sites. The goal of the grading and site development planning will be to minimize alteration of the cinder cone as it presently exists, maintain the general shape and form of the cinder cone as it presently exists and to stabilize the cinder cone in the on-site construction and installation areas. McLaren WDT at 20.

269. Prior to the start of construction, the CARA Construction Manager and the on-site construction and installation contractors will finalize a "Construction Best Management Practices Plan" ("BMP") in consultation with the OMKM and UH. The BMP will address issues such as the process to be followed if an inadvertent discovery of human remains or archaeological properties was made, development of specific methods to protect the attributes of any historic properties which may be found within the project site, staging areas and within the immediate vicinity of the project area. McLaren WDT at 20.

**D. Compliance with H.R.S. Section 6E**

270. UH is required to comply with HRS Chapter 6E, entitled "Historic Preservation." In a letter dated May 16, 2002, Don Hibbard from the State Historic Preservation Division confirmed that completion of the Section 106 process and the signing of the MOA satisfied the University of Hawai'i's obligation to comply with Hawai'i State Historic Preservation Law. Mr. Hibbard wrote, "In accordance with Section 6E-8, Hawai'i Revised [S]tatutes the historic preservation office concurs with the proposed W.M. Keck Observatory Outrigger project with the coordination that the stipulations set forth in Section 106 MOA are followed." McLaren WDT at 21; Exhibit A39.

**E. Mauna Kea Historic Preservation Plan**

271. The Mauna Kea Historic Preservation Plan, Management Components ("Historic Preservation Plan") was prepared by the State Historic Preservation Division for the Institute for Astronomy, University of Hawai'i in March 2000. Exhibit A10 p. 3443.

**F. Burial Treatment Plan**

272. A qualified project archaeologist will be present on site to monitor all excavation in order to avoid damage to inadvertently discovered remains or subsurface artifacts, and to ensure that appropriate follow up action is taken. McLaren WDT at 19-20. This condition is contained in the MOA for this project which also sets forth the qualifications and duties of the project archaeologist. McLaren WRT at 5; Exhibit A24.

273. Pursuant to the MOA, an Inadvertent Discovery of Human Remains and Archaeological Properties monitoring plan will be developed by the project archaeologist, which will comply with draft State Historic Preservation Division Rules (Titles 13-275, 13-279, and 13-280). CARA will submit this plan for review by Consulting Parties of the MOA. Thereafter, CARA will submit the plan to the Hawai‘i State Historic Preservation Officer (SHPO) and OMKM for approval. Bell WDT at 4.

274. The Archaeological Monitoring Plan will include burial and notification components that comply with Hawai‘i Revised Statutes Section 6E-43.6 (Inadvertent Discovery of Burial Sites), and Hawai‘i Administrative Rules Title 13-300-40 (Inadvertent Discovery of Human Remains) for the burial components; and with applicable draft State Historic Preservation Division Rules (e.g., Sections 13-275-12, 13-279-1 et seq., and 13-280-1 et seq.) for the archaeological components. The burial treatment component will reflect a preference, to the extent practicable, and if confirmed to be culturally appropriate, for any human remains found to be preserved in place. Bell WDT at 4. Hawai‘i Revised Statues section 6E-43.6, however, does not require consultation with the Hawaii Island Burial Council.

275. Mauna Kea is a historic burial ground of the highest born and most sacred Hawaiian ancestors. Exhibit F-5 at p 7.

276. Hawaiians buried the bones of their dead on the slopes of Mauna Kea. Exhibit A-10 at Bates Stamp 3846.

277. Modern Hawaiian Practitioners, continue the traditional practice using Mauna Kea as a burial place. Maly WDT at 32.

278. To date the only positively identified human remains found in the Science Reserve are on the …summit of Pu‘u Makanaka…Four other sites within the Science Reserve have been identified as possible burials by [Archaeologist] McCoy. Exhibit A-10 at Bates Stamp 3849.

### G. Lake Waiau and Surrounding Pu‘u

279. Lake Waiau and the pu‘u surrounding it are traditional cultural properties. Many practices are conducted there, the water contained in the lake is considered the most sacred in all of Hawai‘i, the waters are sacred waters of Kane. The water is collected for ritual, medicinal, and ceremonial practice. Maly WDT at 32.

280. The three pu‘u, Poli‘ahu, Lilinoe and Waiau are named for three sister goddesses who are female forms of water…Poli‘ahu is embodied in the snow, Lilinoe in the mist and Waiau in the lake." Exhibit A-10 at Bates Stamp UH3851)

281. The lake was used for navigational purposes and the study and understanding of heavens: "We [Kamakahukilani von Oelhoffen and Kealoha Pisciotta] went there because Aunty wanted to show me how the lake [Waiau] is like the *Wai Ea* –water bowl in the Anu‘u tower or navigational gourd…the heavens can be viewed perfectly there…*Wakea* [star constellation Orion] can be seen traversing over head." Pisciotta Tr., 02/25/03, p 172-173.

282. The shrines around the lake the mark the cardinal directions [North, South, East and West]. Pisciotta Tr., 02/25/03, p 172-173.

## H. View Planes/Visual Impacts

283. The telescopes are actually an obstruction of sight. When Hawaiians go up there, they cannot turn 360 degrees and see all the places - they have to walk around the telescopes. Exhibit F-5 in App. I-K at 6-7.

284. The visual impacts cannot only be evaluated from the ground view looking upward but must also include the perspectives from the summit area itself. Neves Tr., 2/25/03, p 138 at 19-25; Exhibit F-5.

285. "Mauna Kea is the baseline for the equinox, because as equally as you can be on Mauna Kea and establish the solstice or equinox alignments in relationship to the pu'u's up there, you can also mark them down below and use Mauna Kea as the reference in the other direction, and that is what is done." Pisciotta Tr., 02/25/03, p 174 at 14-20

286. The proposed located of the Outrigger Telescopes will interfere with the view from Pu'u Hau Oki to Haleakala. Neves, Tr., 02/25/03, p 138 at 19-25, p 139 at 1-2.

287. Alterations to the sacred landscape prohibits, changes and impedes traditional and cultural practices. Exhibit F-5, Appendix I-K at 6-7.

288. "Alterations to the sacred landscape destroy reference points critical to the potency of Native Hawaiian oral traditions." Exhibit F-5.

## I. Religious Practices

289. Intervenors who are Hawaiian cultural practitioners referred to Mauna Kea as "sacred." Fergerstrom Tr., 2/25/03, p 97:12-16; Pisciotta Tr., 2/25/03, p 158:11-12, p 163:25, p 164:20-23, p 165:20; Neves Tr., 2/25/03, p 143:21-22; Ching Tr., 2/24/03, p 177:17; Ching WDT at 2-3; Fergerstrom Tr., 2/25/03, p 97:12-16; p 99:14, p 102:3, p 103:9.

290. As stated by Mr. Fergerstrom, "The entirety of Mauna Kea is sacred. In specific, the summit area is of extraordinary significance and sanctity. It is known as the realm or po. This is the place where mankind acknowledges the boundaries between heaven and earth." Fergerstrom Tr., 02/25/03, p 97:12-16.

291. Native Hawaiians regard Mauna Kea as a sacred area. Kanahele Tr., 2/12/03, 55:12-15.

292. Religious worship is conducted on Mauna Kea. Trask Tr., 2/12/03, p 79:21-25 and p 90:20-91:1.

293. In August 2002, after filing his petition for this contested case hearing, Clarence Ching and another person led a huaka'i, which was Ching's way of practicing his religion and spirituality. Ching Tr, 2/24/03, p 167:3-11.

## J. Contemporary Cultural Practices

294. The Maly Report identified the following contemporary cultural practices on Mauna Kea: (1) prayer and ritual observances – including construction of new kūahu (altars) as part of ceremonial observances; (2) the "on-going contemporary practice of collection of stone from adze quarry sites for various purposes" and (3) "subsistence and recreational hunting." Exhibit F14 at Table 2c, p. 33.

295. Mr. Ching testified that on one occasion he practiced a contemporary hoʻokupu ritual at the lele on the summit of Puʻu Wēkiu, but offered no testimony regarding any traditional or contemporary cultural practice on the WMKO site or in Puʻu Hau ʻOki crater. Ching WDT at 2.

296. Practices at the lele at Hale Pōhaku are contemporary practices. The lele at Hale Pōhaku was "put together some years back" by ROOK I. Neves Tr. 2/25/03 at 143:21-22. Its "function was to help reacknowledge the sacred nature." Pisciotta Tr., 02/25/03, p 167:23-168:3.

297. According to Ms Pisciotta, a certain part of a particular constellation could not be viewed from the lele on Puʻu Wēkiu because of the existence of the Gemini telescope. Pisciotta Tr., 2/25/03, p 13:21.

298. From the site visit, it was noted that the existing Keck I and Keck II telescopes, the WMKO site, and Puʻu Hau ʻOki crater are not visible from the summit of Puʻu Wēkiu.

299. The ROOK I engages in a contemporary practice of "offering of the hoʻokupu and our journey" to the summit. Neves Tr., 2/25/03, p 20-21.

300. Ms. Pisciotta placed her family's hoʻokupu stone near the road to the summit in about 1995. Exhibit F27 at top of unnumbered page 2 (hoʻokupu stone "has been there over 4 ½ years"). She was not certain about whether her family's shrine was located in the Mauna Kea Science Reserve or the Natural Area Reserve. Pisciotta Tr., 2/25/03, p 13-21. The practice of placing her family's shrine is a contemporary practice.

301. The disassembly of Ms. Pisciotta's family ahu by astronomy personnel in 1997 was done because of a very unfortunate error in the University's procedures at that time. The employee did not understand the significance of the site and was following instructions to remove foreign objects and structures left behind by visitors. McLaren WRT at 5; McLaren Tr., 2/12/03, p 248:17-23.

302. Following the incident, UH IfA wrote to Ms. Pisciotta to apologize. Thereafter, several new policies were instituted by the University and Mauna Kea Support Services to eliminate the possibility of this type of mistake occurring in the future. Pisciotta Tr. 2/25/03 at 162:9-13; McLaren WRT at 5; Exhibit F28.

303. From Pu‘u Hau ‘Oki one can see Haleakala and Haukea, which are significant to Mr. Neves’ family. When the Outrigger Telescopes are constructed this view would be obstructed. Neves Tr., 2/25/03, p 138:11-25.

## VIII. ACCESS

304. Access to the summit of Mauna Kea is governed by the 1995 Management Plan which was approved by DLNR and which provides in part,

> Unscheduled Closings of the Access Road. UH may close any or all portions of the road between Hale Pohaku and the summit if it is determined that hazardous conditions exist. The road will also be closed when it is being cleared of snow and when it is being otherwise worked on due to snow conditions . . . During and immediately after snow removal and road maintenance activities, official vehicles (those identified as being associated with UH and the telescopes) shall have priority over private vehicles or those of commercial operators.

1995 Management Plan at 8, Exhibit A19 (App. D).

305. On January 20, 2002, Mauna Kea was closed to the general public for compelling safety reasons, the presence of ice and snow on the road and particularly because snow removal equipment was working on the roadway, which poses a potential hazard to vehicular traffic. Stormont WRT at 1.

306. Deborah Keomailani Van Gogh and Petitioner Kealoha Pisciotta were denied access to the summit on January 20, 2002. Van Gogh Tr., 2/24/03, p 180:8-181:16.

307. On January 20, 2002, OMKM Rangers recorded that there were over 100 cars waiting to proceed up Mauna Kea. OMKM treats all members of the public the same particularly when safety is at issue. An unmanageable and chaotic situation would result at roadblocks if certain members of the public were allowed to proceed while others were not. It is not OMKM’s nor the Master Plan’s intent to restrict access to the general public. It is only reasonable to expect that the road will be closed from time to time due to unsafe or impassable conditions. Stormont WRT at 1-2.

308. When the snow removal equipment is on the road, it blocks off an entire lane and vehicles are required to drive around it. Therefore only a limited number of vehicles can be accommodated on the road while the snowplow and snow blower are operating. Observatory staff are properly equipped, experienced and knowledgeable regarding how to safely proceed around the snow removal equipment. Even though they are experienced, observatory staff are permitted access only when it is safe for their vehicles to proceed and when there are cleared areas on their property to park their vehicles. Stormont WRT at 2.

309. On January 20, 2002, as sections of the road were cleared of ice and snow and deemed safe for vehicular traffic, those sections were opened to the general public. Stormont WRT at 2.

## IX. FLORA AND FAUNA

### A. Flora

310. On the slopes of Puʻu Wēkiu, a slope with numerous large rocks support a substantial colony of lichen, and an area north of Puʻu Poliahu is characterized by a rich variety of lichens including *Umbilicaria pacifica* and by *Pseudephebe pubescens,* collected for the first time in Hawaiʻi (or any tropical alpine region) during the 1982 Mauna Kea botanical survey. (F-30 MKSRCDP p 35;A-7 MKMP2000 IV-2)

311. No botanic field surveys and site monitoring were reported between 1982 survey incorporated into the 1982 EIS, and the review of literature and limited survey in 1999. (A-25 BS 4036 FEA 2002 p 74)

312. Puʻu Hau ʻOki, the proposed location of the Outrigger Telescopes Project, is at an approximate elevation of 4,146 m (13,603 ft) within the summit area cinder cones. The summit area cinder cones are characterized by harsh environmental conditions that limit the composition of the resident floral and faunal communities found there. Exhibit A25 at Bates Stamp 4034.

313. No floral species have been found on the summit area cinder cones. Plants have been found only below the summit area cinder cones. The extreme temperatures and very dry conditions of the cinder cones, including limited precipitation, porous cinder substrates, and high winds, have apparently prevented establishment of even very hardy plants. The summit area cinder cones receive almost no rainfall, and snow accumulates only during a short winter season. Temperatures often drop below freezing at night. Solar radiation is extreme, and evaporation rates are high. Exhibit A25 at Bates Stamp 4034.

314. Since there are no floral species at the WMKO site, on-site construction and installation of up to six Outrigger Telescopes would have no impact to this component of the natural environment of Puʻu Hau ʻOki. Exhibit A25 at Bates Stamp 4069.

315. Vegetation is also sparse within the elevations of the Mauna Kea Science Reserve below the summit cinder cones. Traffic along the Access Road in these lower elevation areas, particularly the heavy truck traffic that would be associated with the Outrigger Telescopes Project, may result in some dust deposition on roadside vegetation. This is expected to be short-term and temporary given that the increase in daily traffic would amount to only about 15 round trips each day, and heavy vehicular traffic would be confined largely to the mobilization and demobilization periods of the on-site construction and installation cycle. On-site construction and installation of the Outrigger Telescopes would not result in any adverse effect to vegetation at the approved construction laydown and storage areas. Exhibit A25 at Bates Stamp 4069.

316. Other than the Wēkiu bug, U.S. Fish and Wildlife Service does not know of any federally endangered, threatened, or candidate species, other significant wetlands, or other Federal trust resources in the immediate summit area of the proposed project site. Exhibit A25 at Bates Stamp 4111.

## B. Arthropods

317. Drs. Brenner, Howarth and Stone were all qualified to testify as experts in the area of entomology. Brenner Tr. 2/12/03 Tr. at 109:6-15; Howarth Tr., 2/24/03, p 16:21-22; Stone Tr., 2/24/03, p 105:6.

318. The only resident animal species found on the summit area cinder cones are arthropods. Eleven species of indigenous Hawaiian resident arthropods have been collected there: the Wēkiu bug (N*ysius wekiuicola*), lycosid wolf spiders (*Lycosa* sp.), sheetweb spiders (*Erigone* sp. A1 & b1), another sheetweb spider (Family Linyphiidae: species unknown), a mite (Family Aystidae: species unknown) another mite (Family Eupodidae: species unknown), springtails (Family Entomobryidae: 2 species unknown), another springtail (Class Collembola, family and sp. Unknown), and a centipede (*Lithobius* sp.). An additional five arthropod species, non-indigenous to Hawai‘i are thought to be resident to the summit area cinder cones. Exhibit A25 at Bates Stamp 4034.

319. Despite their rarity, critical habitat for these species is unknown or poorly defined because very little is known about their life cycle, population size, fecundity, and area distribution. Exhibit F-30 MKSRCDP p 35, 54; Exhibit A-7 MKMP2000 XI-22.

320. One true bug, a new species of the worldwide genus *Nysius*, was discovered on the summit in 1982, and named *Nysius wekiuicola* or Wēkiu bug. The Wēkiu bug is most commonly found on the slopes of tephra cinder cones above 11,800 feet under large boulders and among cinders. Exhibit A-25 BS 4034 FEA 3.6.1.

321. The 1982 study identifies five major habitat types, with the sixth being snow patches. The preferred habitat for the Wēkiu was type two, tephra ridges and slopes. In the loose accumulations of tephra, the deeper the cinders, the better the habitat. The depth of the cinder and the slope of the crater are critical to the quality of habitat. As temperature changes the bug can move up and down through the cinders to find the temperature ideal, so it needs the vertical extent. Howarth Tr., 2/24/03, p 22, p 27.

322. Pu‘u Wēkiu and Pu‘u Hau Oki were found to be the cinder cones with the best habitat and the greatest number of Wēkiu bugs. Exhibit F-30, pp 9 and 17; Exhibit F-30, Mauna Kea Science Reserve Complex Development Plan, pp 54,56.

323. A period of fifteen years of no monitoring between 1982 and 1997 caused a great loss of potentially useful data regarding what happened to the population of the bug. Howarth Tr., 2/24/03, p 38.

324. The February 2002 FEA (p 73) states that in 1997/8 a second arthropod assessment concluded that a 99.7% decline in Wēkiu bug populations in comparable areas surveyed. Exhibit A-25, Bates Stamp 4035, FEA p. 73.

325. Currently the Wēkiu bug population has declined to the point that the bug is a candidate for listing as an Endangered Species, based on two criteria; its known threats are impacting the population of the organism, and there’s evidence of significant population decline. Howarth Tr., 2/24/03, p 45.

326. The Wēkiu bug was listed in June 13, 2002 as a candidate for endangered or threatened status. Stone WDT at 3.

327. Dr. Brenner testified that Wēkiu bug counts were high in 1982 "…even though 6 telescopes had already been installed at the summit, and most of the roads were already constructed." Brenner WDT at 30.

328. The area of the WMKO site that was leveled for construction of the Keck I and Keck II Telescopes, is subject to daily use for WMKO activities including vehicle parking and foot traffic, and does not harbor substantial resident populations of any of the eleven resident Hawaiian arthropod species known to inhabit the summit area cinder cones. Most of the on-site construction and installation activity for the Outrigger Telescopes, and all of those activities for Outrigger Telescopes 5 and 6, would occur within that area.

329. Dr. Stone stated that the 1997-98 field assessment of the Wēkiu Bug "revealed extremely low population numbers with only a few dozen individuals recorded," Stone WDT at 4.

330. While past studies suggest that Wēkiu bug populations may have experienced significant declines, recent research has provided evidence that Wēkiu bug populations may be increasing or at least stabilizing at some new level. Recent surveys have also shown that Wēkiu bug distribution is far more extensive than previously thought. Brenner WDT at 4.

331. Wēkiu bugs utilize the voids in the surface layer of cinder as hiding spaces, thermal cover, and passageways for movement. Wēkiu bugs have not been found in or below the ash layer. They are not burrowing insects, and are not thought to be able to penetrate either the ash layer or the compacted ash/cinder mix at deeper levels. Brenner WDT at 5.

332. Wēkiu bug habitat is thought to be limited to the 12 to 18 inches of washed and size-sorted cinder on the surface and slopes of the Mauna Kea cinder cones above 11,800 feet. This conclusion is based on evidence gathered during the 1982 and 1997/98 Wēkiu bug studies and from Dr. Brenner's personal observations during research he has conducted in Wēkiu bug habitat. This hypothesis is also supported by information gathered during a recent Wēkiu bug survey in which the highest trap capture rates were recorded in areas of cinder consisting of 1 to 4 inch size cobbles loosely packed at the surface (Englund et al. 2002, Exhibit F-44). Brenner WDT at 5.

333. Wēkiu bug habitat consists of two substrate types: Type 2 and Type 5 habitat (Howarth and Stone 1982). Type 2 habitat is found on tephra ridges and slopes with scoria and lapilli deposits. Brenner WDT at 5; Howarth Tr. 2/24/03 at 21:24 – 22:5. Wēkiu bugs have been found to be most abundant in this habitat where there are stable accumulations of loose cinder and tephra rocks large enough (1 cm and larger) to create interstitial spaces that allow Wēkiu bugs to migrate downward to moisture and shelter. Type 5 habitat has been described as talus slopes and highly fractured rock outcrops. Wēkiu bugs are less abundant in this habitat type, and are thought to prefer Type 2 habitat. Brenner WDT at 5.

334. Most Wēkiu bug surveys have used traps for sampling. Traps measure activity rates, not population densities; however, for many insect species the percentage of the population that is foraging is roughly constant over time during equivalent seasons and environmental conditions. Therefore, when conditions are similar, it is logical to assume that higher Wēkiu bug trap capture rates indicate higher population densities. Brenner WDT at 6.

335. Historically, the highest Wēkiu bug trap capture rates were recorded from the cinder cones at the summit of Mauna Kea, specifically Puʻu Hau ʻOki, Puʻu Kea, and Puʻu Wēkiu, but Wēkiu bugs have been collected in several areas of identified suitable habitat in the Mauna Kea Science Reserve above 11,800 feet elevation (Howarth and Stone 1982, Exhibit B-2; Howarth, Brenner, and Preston 1999, Exhibit A7 at Bates Stamp 2882-2948; Polhemus 2001, Exhibit F-44; Englund, et al. 2002, Exhibit F-44). In 2001, sampling of Puʻu Haukea revealed that it is another location where trap capture rates were large, and the site was considered to have a significant Wēkiu bug population (Polhemus 2001, Exhibit F-44 at Appendix 1). Brenner WDT at 6.

336. In surveys and monitoring conducted in 2002, Wēkiu bugs were found to be widespread in suitable habitat throughout sampled areas in the Mauna Kea Science Reserve above 11,800 feet elevation. One survey demonstrated a pronounced pattern of bugs becoming more common in traps as elevation increased (Englund, et al. 2002, Exhibit F-44). Monitoring under similar conditions and within a reasonable time frame supported this observation (Pacific Analytics 2002 a – d, Exhibits A28 – A31). The highest trap capture rates in 2002 were recorded on the summit cinder cones, specifically Puʻu Hau ʻOki and Puʻu Wēkiu. Brenner WDT at 6.

337. In general, Wēkiu bugs appear to prefer habitat located near the outer rims and inner craters of the alpine cinder cones. 2002 monitoring in Puʻu Hau ʻOki found Wēkiu bugs almost evenly distributed along the entire elevation of the inner slope (Pacific Analytics 2002 a – d, Exhibits A28 - A31). Brenner WDT at 6-7.

338. The construction of the Outrigger Telescopes will have an impact on a small area of the Wēkiu bug habitat. However, engineering designs for on-site construction and installation have attempted to minimize, reduce, or avoid impacts to Wēkiu bug habitat. As a result of design changes, only about 975 square feet (0.009 ha (0.022 acre)) of Wēkiu bug habitat adjacent to the WMKO site would be directly affected by the on-site construction and installation of the proposed project. Disturbance in this habitat will temporarily displace Wēkiu bugs. Brenner WDT at 11 as modified by Brenner Tr., 2/12/03, p 107:22-108:6.

339. It is unlikely that the Outrigger Telescopes Project will have any long-lasting impacts to Wēkiu bugs. Brenner WDT at 11.

### 1. Project Redesign to Avoid Impact to Wēkiu Bug Habitat

340. On-site construction and installation of an air pipe and retaining walls needed for slope stability at Junction Box (JB) 5 near Outrigger Telescope 2, and at Outrigger Telescope 3 would result in the loss of about 975 sq. ft. of the sloped cinder cone wall that is Wēkiu bug habitat in those areas. Specifically, at JB-5 near Outrigger Telescope 2, the

retaining wall would extend into and displace about 350 sq. ft. (0.003 ha (0.008 ac)) of the sloped area habitat. At Outrigger Telescope 3 the air pipe and retaining wall would displace about 625 sq. ft. (0.006 ha (0.015 acre)) of the sloped wall area Wēkiu bug habitat. Brenner WDT at 11-12.

341. In the area near JB-5 which services Outrigger Telescope 2, there will be approximately 350 square feet of habitat disturbance. In order to conservatively over-estimate the amount of habitat disturbance, however, a 310 foot buffer zone within a snow fence is included in the 350 square foot area of disturbance. Brenner Tr., 2/12/03, p 116:25-117:13; Exhibit A42.

342. In the area near Outrigger Telescope 3, there will be an area of approximately 425 square feet of habitat disturbance. In order conservatively over-estimate the amount of habitat disturbance, however, a 200 square foot buffer zone has been included in the area of disturbance. Brenner Tr., 2/12/03, p 117:20-118:4; Exhibit A42.

343. In another area near Outrigger Telescope 3, there will be an area of approximately 200 square feet of habitat disturbance. Brenner Tr., 2/12/03, p 118:5-9; Exhibit A42.

344. The potential impacts to Wēkiu bug habitat have changed since the Outrigger Project was first discussed. Dr. Brenner has been involved in the site design since 1999. He reviewed proposed site grading and construction plans and made recommendations to reduce and minimize disturbance to Wēkiu bug habitat. Through value engineering, ongoing research efforts, and discussions with project engineers, modifications were made based on his recommendations that have significantly reduced the amount of Wēkiu bug habitat that would be disturbed. Brenner WDT at 12.

345. An initially proposed site design placed Outrigger Telescope 1 and JB-3 very near a potential Wēkiu bug habitat area. Dr. Brenner pointed this out to project engineers. As a result, the proposed site for Outrigger Telescope 1 was moved 4 meters closer to the WMKO and JB-3 was incorporated into the coudé room below OT1. The design change resulted in moving the edge of the disturbance zone 25 feet closer to the WMKO, safely away from potential Wēkiu bug habitat. Brenner WDT at 12; Brenner Tr., 2/12/03, p 118:18-119:20; Bell Tr., 2/10/03, p 210:1-3.

346. Another significant modification was the design of the retaining wall below JB-5 near Outrigger Telescope 2. The first proposal called for fill to be added to the slope. This option was unacceptable because of the amount of Wēkiu bug habitat that would be disturbed. The next option was for a sloped retaining wall of hollow blocks. The problem was that constructing such a wall would involve disturbing about 3000 sq. ft. of habitat. Dr. Brenner called this to the attention of project engineers, and Jim Walker of CARA suggested a vertical retaining wall. He worked on the engineering aspect and the retaining wall was moved immediately adjacent to JB-5. It was originally planned to be 12 feet from JB-5, and was first moved in to 9 feet from JB-5 and then to its present location of 2 feet from JB-5. The current design calls for a "Z" shaped retaining wall, along with changing the orientation of JB-5 (at a cost to science), moving the junction box and retaining wall closer to the WMKO and

disturbing even less Wēkiu bug habitat. The total area of habitat disturbance near JB-5 has now been reduced from over 3000 sq. ft. originally, to less than 350 sq. feet. Brenner WDT at 12-13; Brenner Tr., 2/12/03, p 119:21-122:7; Bell Tr., 2/10/03, p 210:4-8.

347. Outrigger Telescope 1 was initially proposed to be placed with a berm and a filled grade. After Dr. Brenner noted that this design would impact habitat, CARA decided to leave Outrigger Telescope 1 at a lower elevation than other areas of the facility. The light will therefore slope uphill as it is directed back to WMKO. There was a loss of Outrigger Telescope scientific efficiency by this modification. Brenner WDT at 13.

348. Also, an initial plan for Outrigger Telescope 3 proposed placement of cinder on the outslope base of that structure. That would have impacted the downhill area. At an additional monetary cost, a retaining wall with a fence has been added which eliminates the necessity of adding fill material. Brenner WDT at 13; Brenner Tr., p 122:8-123:8.

349. Outrigger Telescope 3 potentially presents the biggest impact to Wēkiu Bug habitat and has therefore received extra attention. The vent tunnel from Outrigger Telescope 3 exits in Wēkiu Bug habitat area, and there is a concrete base at the end of the vent. CARA has figured out a way to bend the tunnel and disturb less habitat. Brenner WDT at 13; Brenner Tr., 2/12/03, p 123:9-123:25

350. The area of habitat (or potential habitat) to be disturbed has been reduced from over 3000 square feet to about 975 square feet. Brenner WDT at 14 as modified by Brenner Tr., 2/12/03, p 107:18-108:6; Brenner Tr., 2/12/03, p 124:1-7.

### 2. Wēkiu Bug Habitat Restoration

351. The goal of Wēkiu bug habitat restoration is to replace habitat disturbed by on-site construction and enhance Wēkiu bug populations by increasing the amount of available habitat. The proposed restoration effort would encompass an area of not less than 2925 square feet (0.028 ha (0.069 ac)) resulting in a habitat restoration ratio of at least 3:1 relative to the amount of habitat area that would be displaced by on-site construction and installation of the Outrigger Telescopes. Brenner WDT at 1415 as modified by Brenner Tr., 2/12/03, p 107:18-108:6.

352. The proposed restoration activity will use cinder excavated for the Outrigger Telescopes as habitat medium. All cinder not used for backfill or site grading will be screened to obtain suitably-sized cinder, which will then be washed and spread in habitat restoration areas. Cinder will be spread about 12 to 18 inches deep. Based on information gathered from Wēkiu bug surveys (Howarth and Stone 1982, Exhibit B-2; Howarth, Brenner, and Preston 1999, Exhibit A7 at Bates Stamp 2882-2948; Pacific Analytics 2002 a – d, Exhibits A28-A31, Englund, et al. 2002, Exhibit F-44), this is believed to be the desired depth range for Wēkiu bug habitation. Habitat restoration areas include below JB-5, the bottom of Puʻu Hau ʻOki crater, and if a sufficient supply of suitably-sized cinder is available, the area north of Outrigger Telescope 1. The restored habitat would be monitored for the establishment of Wēkiu bugs for at least 18 months after restoration is complete. Brenner WDT at 15; Brenner Tr., 2/12/03, p 124:13-125:16; Exhibit A42.

353. At least three times the amount of displaced habitat (estimated to be about 975 sq. ft.) would be restored. Given estimates of the quantity of cinder that may be available for restoration, an area up to about ten times the amount of displaced habitat may be restored. Brenner WDT at 15 as modified by Brenner Tr., 2/12/03, p 107:18-108:6.

354. The habitat restoration protocol is based on the best scientific information available about the habitat needs of the Wēkiu bug, and during the development of the protocol all information contained in scientific literature was considered. Since their discovery was reported in 1980 (Howarth 1983) at least nine studies have provided information about the habitat requirements of Wēkiu bugs (Howarth and Montgomery 1980; Howarth and Stone 1982, Exhibit B-2; Ashlock and Gagne 1983; Duman and Montgomery 1991; Polhemus 1998; Howarth, Brenner, and Preston 1999, Exhibit A7 at Bates Stamp 2882-2948; Polhemus 2001, Exhibit F-44 at Appendix 1; Pacific Analytics 2002 a – d, Exhibits A28 - A31; Englund, et al. 2002, Exhibit F-44). Five of these studies included extensive sampling and assessment of habitat on Mauna Kea (Howarth and Stone 1982, Exhibit B-2; Howarth, Brenner, and Preston 1999, Exhibit A7 at Bates Stamp 2882-2948; Polhemus 2001, Exhibit F-44 at Appendix 1; Pacific Analytics 2002 a – d, Exhibits A28 – A31; Englund, et al. 2002, Exhibit F-44). The protocol is based on information from those studies. Brenner WDT at 15-16. Exhibit A-25 at Bates Stamp 4069.

355. The habitat restoration protocol is based on the fact that Wēkiu bugs appear to prefer habitat made of loose cinder ½ inch size or larger. Wēkiu bug studies (Howarth and Stone 1982, Exhibit B-2; Howarth, Brenner, and Preston 1999, Exhibit A7 at Bates Stamp 2882-2948; Pacific Analytics 2002 a – d, Exhibits A28 - A31; Englund, et al. 2002, Exhibit F-44) have found the highest concentration of Wēkiu bugs in habitat consisting of 10 to 15 inches of ½ inch size or larger cinder, with an impenetrable ash layer below the cinder. This information supports the conclusion that restored habitat consisting of 12 to 18 inches of loose ½ inch size or larger cinder will be acceptable to Wēkiu bugs. Brenner WDT at 16; Brenner Tr. 2/12/03 at 127:10-19.

356. The habitat restoration protocol is based on the fact that Wēkiu bug habitat occurs on crater floors of summit cinder cones. Wēkiu bugs are found on the crater floors of Pu‘u Hau ‘Oki and Pu‘u Wēkiu. In 1982, Wēkiu bugs were collected on the crater floor of Pu‘u Wēkiu and on the crater floor of Pu‘u Hau ‘Oki. During the 1997/98 Arthropod Assessment, Wēkiu bugs were again found in both of these cinder cones. During Baseline Monitoring, Wēkiu bugs were also found in trap 5 in Pu‘u Hau ‘Oki crater, less than 25 feet away from the major area of habitat restoration. This information supports the conclusion that the crater floors are still used by Wēkiu bugs, and that restored habitat on the floor of Pu‘u Hau ‘Oki crater will likely be occupied by Wēkiu bugs. Brenner WDT at 16; Brenner Tr., 2/12/03, p 127:20-23.

357. The habitat restoration protocol is based on the fact that given sufficient time, Wēkiu bug habitat appears to recover from disturbance. Of all sites sampled during the 1997/98 Arthropod Assessment, Exhibit A7 at Bates Stamp 2882-2948, habitat on the slopes below WMKO that were disturbed during construction of the WMKO contained the highest concentration of Wēkiu bugs. Wēkiu Bug Baseline Monitoring has recorded an increase in Wēkiu bug captures in this area suggesting that the population may be increasing. This

information supports the conclusion that Wēkiu bugs could eventually occupy restored habitat. Brenner WDT at 16.

358. A recent study by the B.P. Bishop Museum found that the greatest Wēkiu bug trap capture rates occurred in habitat composed of scoria and lapilli deposits of "loose cinder and tephra where interstitial spaces were large enough to allow the insects to migrate downward in times of inclement weather or nighttime to find moisture and shelter." (Page 23-24 in Englund, et al. 2002, Exhibit F-44). This research supports Dr. Brenner's observation that Wēkiu bugs appear to prefer the kind of habitat that will be created. Brenner WDT at 17.

359. Habitat restoration will be composed of screened cinder larger than ½ inch, washed with water to remove ash. Exhibit A13 at 12; Exhibit A27 at 2.

360. Cinder will be spread 12 to 18 inches deep in the habitat restoration areas, and will form a complete interface with cinder in adjacent Wēkiu bug habitat. It may be necessary that cinder be spread more than 18 inches deep in some places, in order to assure the necessary contact with existing habitat. Brenner Tr., 2/12/03, p 127:24-128:7; Exhibit A27 at 2-3.

361. Dr. Brenner estimated that the probability of success of the habitat restoration is between 80 and 100 percent. Brenner Tr., 2/12/03, p 175:4-19.

362. Dr. Howarth agreed that habitat restoration on sloped areas would be suitable, and that habitat could be restored in an area that is not currently occupied as habitat. Howarth Tr., 2/24/03, p 44:10-20.

363. Dr. Stone's testimony that further study is needed before habitat can be restored is contradicted both by the testimony of Dr. Howarth and Dr. Brenner, by the DLNR's Site Plan Approval for a Wēkiu Bug Habitat Restoration Project on the floor of the Puʻu Hau ʻOki crater, Exhibit A19 at Bates Stamp 02972-02985, and by the United States Fish and Wildlife Services' (USFWS) support of the habitat restoration. See Exhibit A25 at Bates Stamp 4222-4224 supporting habitat restoration recommendations in the Wēkiu Bug Mitigation report, Exhibit A13.

### (i) Habitat Restoration Near Outrigger Telescope Number Two

364. For the habitat restoration proposed near OT2, Dr. Howarth agreed that the restoration would have a good probability of success if large cinders are placed on the slope and monitoring is conducted and adjustments are made as necessary. Howarth Tr., 2/24/03, p 60:15-60:21. Dr. Howarth also conceded that the depth of cinders was less critical in this context. Howarth Tr., 2/24/03, p 59:18-25.

365. The habitat restoration proposed near OT2 will be on a slope, includes the use of cinder larger than ½ inch, Exhibit A27 at 2, and also includes monitoring, Exhibit A20 at Bates Stamp 03076-77. According to the Wēkiu Bug Mitigation Plan, "It may be necessary that cinder be spread more than 46 cm (18 inches) deep in some places, in order to assure the necessary contact with existing habitat." Exhibit A25 at Bates Stamp 4155.

### (ii) Habitat Restoration Near Outrigger Telescope Number One

366. For the area near OT1, Dr. Howarth agreed that the restoration plan would be reasonably probable of having success if suitably sized cinder meets the slope, monitoring is conducted, and so long as disturbance of the adjacent undisturbed Wēkiu bug habitat is minimized. Howarth Tr., 2/24/03, p 61:17-62:21.

367. The area of habitat restoration near OT1 will be on a slope and will use cinder larger than ½ inch. Exhibit A27 at 2. Monitoring will be conducted. Exhibit A27 at Bates Stamp 03076-77. The design of OT1 has been modified to minimize disturbance to existing Wēkiu bug habitat. Brenner WDT at 12.

### (iii) Habitat Restoration on the Floor of Puʻu Hau ʻOki Crater

368. DLNR has already granted site plan approval for a Wēkiu Bug Habitat Restoration Project on the floor of the Puʻu Hau ʻOki Crater ("DLNR Site Plan Approval"), Exhibit A19 at Bates Stamp 02972 to 02985, and UH IfA's CDUA for the Outrigger Telescopes Project does not request approval for Wēkiu Bug Habitat Restoration on the floor of the Puʻu Hau ʻOki Crater.

369. Dr. Stone criticized the depth of screened cinder used to create the Wēkiu bug habitat restoration, and indicated it should be deeper than the planned 12-18 inches. Stone WRT at 4. Dr. Howarth conceded that he knew of no study that determined the depth of cinders in preferred Wēkiu bug habitat. Howarth Tr., 2/24/03, p 22:16-17.

370. Dr. Howarth was unaware of the DLNR site plan approval for habitat restoration on the floor of Puʻu Hau ʻOki crater. Howarth Tr. 2/24/03 at 70:18-71:21; Exhibit A19 at Bates Stamp 2972-2974.

371. Dr. Howarth agreed that the proposed habitat restoration on the crater floor, which would tie in the crater floor restoration area with the slope of the crater was more beneficial than covering the whole crater bottom, especially where the Wēkiu Bug Mitigation Report, Exhibit A13, and the Wēkiu Bug Mitigation Plan, Exhibit A27, specify that the crater floor will be unevenly deposited. Howarth Tr. 2/24/03 at 67:17-68:7; Exhibit A13 at 12; Exhibit A27 at 3.

372. DLNR's Site Plan Approval for the habitat restoration on the floor of Puʻu Hau ʻOki Crater requires that the depth of the screened cinder be spread 12 to 18 inches deep. Exhibit A19 at Bates Stamp 02972.

373. The USFWS also supported the recommendation for habitat restoration with the depth of cinder of 12 to 18 inches. *See* Exhibit A25 at Bates Stamp 4222-4224 supporting Wēkiu Bug Monitoring Report (Exhibit A13 at 12) which recommends cinder spread 12 to 18 inches deep.

### 3. Wēkiu Bug Mitigation Plan

374. The Wēkiu Bug Mitigation Report for the Outrigger Telescopes Project, Exhibit A13, addresses five major concerns related to the on-site construction, installation, and operation of the Outrigger Telescopes at the WMKO site that have the potential to impact Wēkiu bug populations: (1) habitat restoration and protection; (2) dust; (3) hazardous materials; (4) trash; and (5) alien arthropods.

375. The Wēkiu Bug Mitigation Plan for the Outrigger Telescopes Project, Exhibit A27 was developed based on recommendations in the Wēkiu Bug Mitigation Report, Exhibit A13.

376. Habitat protection is the sum of the actions taken that will minimize or eliminate disturbance to existing Wēkiu bug habitat during on-site construction and installation of the Outrigger Telescopes. Several habitat protection measures have been proposed and will be followed during the construction and operation of the Outrigger Telescopes. They include (1) the use of temporary barriers to prevent cinder and other materials from being side-cast into Wēkiu bug habitat; (2) the placement of education signs to inform visitors of the sensitive nature of Wēkiu bug habitat; (3) continuing current practices for dealing with on-site deep snow events; (4) applying water to excavation sites and cinder stockpiles to reduce dust; (5) suspending dust-generating activities during high winds to prevent dust from reaching Wēkiu bug habitat; (6) using soil-stabilizers sparingly on site, and never in Wēkiu bug habitat or on cinder to be used for habitat restoration; (7) continuing to follow federal guidelines specifying the use and disposal of hazardous substances; (8) minimizing the amount of on-site paints, thinners, and solvents, and cleaning painting equipment away from the summit area; (9) tightly covering construction trash containers to prevent debris from being blown into Wēkiu bug habitat; (10) covering and anchoring in place, on-site construction materials susceptible to movement by wind; (11) securing outdoor trash receptacles from wind-blown movement; (12) removing wind-blown debris from Wēkiu bug habitat only after consultation with an entomologist; (13) pressure-washing and inspection of earthmoving equipment to remove soil, dirt, and vegetation debris that can harbor alien arthropods; (14) inspection and removal of all alien arthropods found from construction materials, shipping containers, packaging materials and observatory equipment before delivery to the summit; (15) monitoring for and eradication of alien arthropods that may potentially be introduced to the summit area; (16) monitoring construction activities for compliance to these protection measures stipulated in the Mitigation Plan. Brenner WDT at 17-18; Exhibit A27.

377. Attractive, non-intrusive, educational signs are proposed to inform people about the sensitive nature of Wēkiu bugs and their habitat. Signs will help prevent unintentional disturbance of habitat by workers and visitors. The signs will be designed in consultation with SHPD and OMKM. Brenner WDT at 18.

378. Both temporary and permanent barriers are proposed to protect Wēkiu bug habitat. Prior to any construction activities, temporary 3-foot high silt fences will be installed along the rim of the Puʻu Hau ʻOki crater, where excavation or trenching is planned to take place within six feet of the slope. These barriers will be maintained by the contractors on a daily basis to repair any damage to the fence, and will prevent side-cast cinder from entering

Wēkiu bug habitat during excavation activity. Permanent barriers are proposed near Outrigger Telescope 1 and Outrigger Telescope 2. These will be similar to highway guardrails and will serve to prevent accidental damage to the Outrigger Telescopes and to limit inadvertent access to Wēkiu bug habitat. Brenner WDT at 18.

379. Alien arthropods are insect and spider species that occur outside of their natural range. It is necessary to protect Wēkiu Bugs from alien arthropods because introduced species might possibly deplete Wēkiu bug food resources and prey on Wēkiu bugs. Brenner WDT at 20.

380. Most alien arthropods introduced to the summit are unlikely to establish viable populations, but the potential exists. If caught early enough, it is possible to eradicate the infestation before the population is established and before they can impact Wēkiu bugs. This will reduce the possibility that alien arthropods will become residents of the Mauna Kea Science Reserve. Brenner WDT at 21.

381. Three major kinds of alien arthropods will be monitored for at the construction site and staging areas: ants, yellow jackets, and spiders. These are considered to be the most damaging alien arthropods and most likely to be introduced (Howarth, et al. 1999). Ants will be monitored at the construction site and the staging areas by using baited traps. The presence of yellow jackets will be monitored using special traps with special attractants. Visual inspection will be used to monitor for the presence of spiders. Brenner WDT at 21.

382. All of the relevant recommendations included in the 1982 and 1997/98 arthropod assessments (Exhibit B-2 and Exhibit A7 at Bates Stamp 2882-2948) have been incorporated into the Mitigation Plan. Several others were added including habitat restoration, monitoring and eradication of alien arthropods, pressure-washing and inspecting construction vehicles, and more stringent guidelines for use of materials that may be hazardous to Wēkiu bugs. Brenner WDT at 22.

383. The U.S. Fish and Wildlife Service supports the recommendations in the Wēkiu Bug Mitigation Plan to minimize project impacts to endemic arthropods on the Mauna Kea summit and minimize the impacts to this high-altitude environment from alien species introductions, garbage generation and collection and visitor use. Exhibit A25 at Bates Stamp 4111.

384. The U.S. Fish and Wildlife Service believes each of the recommendations made in the Wēkiu Bug Mitigation Plan "will greatly minimize the possibility of negative impact to Wēkiu bug habitat." Exhibit A25 at Bates Stamp 4111.

385. The Wēkiu Bug Mitigation Plan requires that water will be applied to excavation sites and cinder stockpiles. Exhibit A27 at 4.

386. The Wēkiu Bug Mitigation Plan requires that dust-generating activities will be suspended during high winds. Exhibit A27 at 4.

387. Dr. Howarth acknowledged that there were dust mitigation measures in the Wēkiu Bug Mitigation Plan. Howarth Tr. 2/24/03 at 71:22-72:4. Dr. Howarth

acknowledged the existence of signs in the WMKO parking lot cautioning drivers to drive slowly so that they do not disturb dust. Howarth Tr. 2/24/03 at 72:8-12. Dr. Howarth also acknowledged that astronomers are very concerned with dust and that it is in the astronomers' interest to ensure that dust is reduced as much as possible not only for the sake of the Wēkiu bug, but also for the sake of their optics, so that they can have the sharpest image possible. Howarth Tr., 2/24/03, p 72:13-21.

388. Dr. Howarth conceded that the Wēkiu Bug Mitigation Plan and Mitigation Report deals with the proper handling of hazardous substances. Howarth Tr., 2/24/03, p 80:9-16.

389. Dr. Howarth expressed concern regarding the use of pesticides on the summit of Mauna Kea. Howarth WDT at 6. Pesticides are not used at the WMKO facility on Mauna Kea. Laub Tr. 2/11/03 at 142:12-14. Dr. Howarth conceded that his concerns had been addressed since pesticides are not used on the summit of Mauna Kea. Howarth Tr., 2/24/03, p 78:11-24.

390. The Wēkiu Bug Mitigation Plan requires that construction trash containers will be tightly covered to prevent construction wastes from being dispersed by wind. Exhibit A27 at 6.

391. Dr. Howarth was aware that the Wēkiu Bug Mitigation Plan requires with regard to debris and waste disposal that the containers be tightly covered and placed in an area where they are not susceptible to movement by wind. Howarth Tr., 2/24/03, p 83:1-84:1; Exhibit A27 at 6.

392. The Wēkiu Bug Mitigation Plan requires that earthmoving equipment will be free of large deposits of soil, dirt and vegetation debris that could harbor alien arthropods. Contractors will be required to pressure-wash earthmoving equipment to remove alien arthropods. Contractors will be required to inspect large trucks, tractors, and other heavy equipment before proceeding up the observatory access road. Exhibit A27 at 7.

393. The Wēkiu Bug Mitigation Plan requires that all construction materials, crates, shipping containers, packaging material, and observatory equipment will be free of alien arthropods when delivered to the summit. Contractors will be required to inspect shipping crates, containers, and packing materials before shipment to Hawai‘i. Contractors will also be required to inspect construction materials before transport to the summit area. Exhibit A27 at 8.

394. Regarding the recommendation in the Wēkiu Bug Mitigation Plan which prevent the introduction of alien arthropods, Exhibit A27 at 8-9, Dr. Howarth was "heartened" with the discussion of this issue in the Wēkiu Bug Mitigation Plan and concurs and supports the recommendation for inspections of containers before they come to Hawaii. Howarth Tr., 2/24/03, p 84:22-85:8.

395. The Wēkiu Bug Mitigation Plan requires that construction contracts will ensure that compliance violations are corrected. Exhibit A27 at 10.

### 4. Wēkiu Bug Monitoring Plan

396. The Wēkiu Bug Monitoring Plan for the Outrigger Telescopes Project, Exhibit A20, includes both compliance monitoring and effectiveness monitoring, along with discussions of data management, analysis and reporting.

397. The Outrigger Telescopes Project has also committed to an extensive monitoring plan if the project is approved. One of the major components of the Wēkiu Bug Monitoring Plan, Exhibit A20, is compliance monitoring. Compliance monitoring will investigate the extent to which contractors, operators, managers, and visitors comply with Wēkiu bug protection guidelines and rules. Random monitoring will occur monthly and violations of the protection measures will be reported in quarterly reports that will be publicly available. Serious violations will be reported immediately to the on-site construction manager and the full-time entomologist/biologist who will have the authority to immediately cease the offending activities. Reports will also be sent to DLNR, OMKM, and other agencies interested and responsible for Wēkiu bug protection. Brenner WDT at 22.

398. Dr. Howarth testified that the construction plan and the Wēkiu Bug Monitoring Plan should include reporting requirements. Howarth Tr. 2/24/03 at 73:15-19. Both the construction plan and the Wēkiu Bug Monitoring Plan include reporting requirements. Exhibit A25 at Bates Stamp 4174; Exhibit A20 at Bates Stamp 03087.

399. The use of live traps designed by Drs. Howarth and Brenner results in a 40% mortality rate. Howarth Tr. 2/24/03, p 46:11-47:6. Dr. Howarth does not know of any other way to conduct field studies of Wēkiu bugs which reduces this mortality rate. Howarth Tr. 2/24/03, p 46:17-19.

400. Dr. Howarth testified that it would be desirable to study the habitat restoration area before, during and after construction. Howarth Tr. 2/24/03 at 70:6-10. The habitat restoration area will be studied before, during, and after construction, Exhibit A20, and Dr. Howarth acknowledged Dr. Brenner's completion of four quarters of monitoring already. Howarth Tr., 2/24/03, p 70:11-13.

401. If the Outrigger Telescopes Project is constructed, the Wēkiu bug will continue to survive on other summit cinder cones. Globally, the Outrigger Telescopes Project will not pose a substantial risk to the existence of the Wēkiu bug. Howarth Tr., 2/24/03, p 33:13-34:3.

402. Previous construction on Puʻu Hau ʻOki has resulted in the summit of the cone being carved off and material pushed down the side, filling the floor of the crater to at least a depth of 40 feet. The wall of the crater was partially breached in carving off the top, resulting in a horseshoe-shaped crater. Howarth Tr., 2/24/03, p 38:21-39:13.

403. Regarding the monitoring of sensitive areas, Dr. Howarth conceded that the Wēkiu Bug Monitoring Plan addressed his recommendation in an admirable and desirable manner. Howarth Tr., 2/24/03, p 80:17-24.

404. Ffurther study of the autecology of the Wēkiu bug has been recommended. Stone WRT at 5-6. As part of project implementation, NASA will fund a graduate student to study Wēkiu bug autecology, and to gather more information about habitat requirements, life cycle, nutritional requirements and breeding behavior. Exhibit A25 at Bates Stamp 4194. Howarth was unaware that this funding had been approved. Howarth Tr., 2/24/03 at 81:13-18.

### 5. Baseline Monitoring

405. While it is important to monitor compliance with the mitigation recommendations, it is also important to monitor their effectiveness in protecting Wēkiu bugs and their habitat. Effectiveness monitoring investigates the changes in Wēkiu bug habitat and population that happen concurrently with construction and operation of the Outrigger Telescopes. Wēkiu bugs will be monitored adjacent to and below the proposed construction site and at a control site on Puʻu Wēkiu for comparison. Brenner WDT at 23.

406. Baseline Monitoring began in February 2002 and has occurred every quarter since. A full year (four quarters) of baseline data has been gathered to use for effectiveness comparisons. Exhibits A28 – A31. Effectiveness monitoring will continue quarterly during the entire construction process and for five years following construction of the Outrigger Telescopes. Brenner WDT at 23.

407. If effectiveness monitoring during construction identifies an impact, the cause of the impacts will be evaluated and new protection measures will be implemented to reduce the impact to Wēkiu bugs. Brenner WDT at 25.

408. Sampling began before permits for the Outrigger Telescopes project were issued because baseline information was needed about the habitat conditions and status of Wēkiu bugs before construction begins so that changes can be detected and impacts evaluated. In their Environmental Assessment, NASA agreed to complete at least two Baseline Monitoring sampling sessions before construction began. It was felt that this would be the minimum amount of information required for scientific comparisons and impact detection. NASA later agreed to extend Baseline Monitoring to four sampling sessions. Brenner WDT at 26-27.

409. The results of Baseline Monitoring will be used to compare capture rates measured during and after construction to determine the effectiveness of habitat protection and determine if any impacts are resulting from outrigger telescope construction. The information is also useful to OMKM to determine peak seasons of Wēkiu bug activity and year to year changes that may influence how Wēkiu bug habitat is managed throughout the MKSR. Brenner WDT at 27.

410. Four quarterly Baseline Monitoring 3-week sessions have been completed. Monitoring occurred in February, May, August and November 2002. The results of this monitoring are documented in the Baseline Monitoring Quarterly Reports dated: April 2002, Exhibit A28; June 2002, Exhibit A29; September 2002, Exhibit A30; and December 2002, Exhibit A31. Brenner WDT at 27.

411. Over the entire 2002 Baseline Monitoring, 696 Wēkiu bugs were captured in traps. This is more than 23 times the amount captured during the 1997/98 Arthropod Assessment. The overall average trap capture rate on Pu‘u Hau ‘Oki in 2002 was 4.85 Wēkiu bugs per trap per 3 days of sampling, more than 12 times greater than that measured in 1997/98. The overall average trap capture rate on Pu‘u Wēkiu was about equal to that measured in 1997/98. Several instances of Wēkiu bugs mating were observed, and sixty-one of the Wēkiu bugs captured during August and November were juveniles (~20%), indicating that the population is breeding. Brenner WDT at 28-29.

412. The Wēkiu bug population on Pu‘u Hau ‘Oki has apparently increased since 1998. This inference is based on comparisons of trap capture rates. Trap capture rates in 2002 were more than 12 times greater than those measured in the 1997/98 arthropod assessment. This is not saying the Wēkiu bug population is 12 times greater, but that given similar sampling conditions (i.e., average weather conditions are about the same, except there was more snow in 2002) greater trap capture rates probably indicate larger populations. Brenner WDT at 29.

413. The project as currently designed and with 5 years of monitoring will benefit the Wēkiu bug by protecting existing habitat, creating more habitat through habitat restoration, and providing scientific data on which habitat management decisions can be based. Brenner WDT at 32.

414. There is sufficient information that Wēkiu bugs will utilize restored habitat. Research by entomologists has characterized the preferred habitat of Wēkiu bugs. Over the last 20 years, during 5 different studies, more than 110 field days (> 325 person days) have been utilized to describe and map Wēkiu bug habitat. The results of these studies have been reported in approximately 250 pages of reports. In addition to this information, habitat descriptions contained in scientific publications were considered during the development of the Wēkiu bug habitat restoration protocol. Brenner WRT at 1.

415. It is unlikely that Outrigger Telescope construction would have a significant impact on the native spider species. Lycosid Spiders are more commonly found on the flat, glaciated areas between cinder cones, not on the cinder cones themselves, where Outrigger Telescope construction would occur. Linyphiid spiders commonly occur on much of the MKSR above 12,800 feet elevation including cinder cones and surrounding glaciated areas and Outrigger Telescope construction is unlikely to disturb their populations. Brenner WDT at 4-5.

416. It is also unlikely that Outrigger Telescope construction would have any significant impact on the other presumed native arthropods. The Summit moth (*Agrotis* sp.) is widely dispersed at high elevations on Mauna Kea. Its larval habitat is believed to be at the base of lava cliffs with large outcrops of andesitic rocks and where lichens and mosses are locally common. Summit moth larvae are thought to feed on foliose lichens, which do not occur in cinder adjacent to the WMKO. Therefore it is unlikely that Outrigger Telescope construction will significantly impact this moth species. The centipede (*Lithobius* sp.) also appears to prefer habitat at the base of lava cliffs, especially where more compact, silty areas occur. This habitat type does not occur near the WMKO. Brenner WDT at 5.

## X. MANAGEMENT

417. The Auditor of the State of Hawaii published the *Audit of the Management of Mauna Kea and the Mauna Kea Science Reserve* in February 1998 (Report No. 98-6) ("Auditor's Report"), in which the Auditor concluded:

> The University of Hawaii's management of the Mauna Kea Science Reserve is inadequate to ensure the protection of the natural resources within the reserve. The State of Hawaii, through the Department of Land and Natural Resources, leased these lands to the university of scientific research. The conditions of the lease, the plan(s) developed, and the Conservation District Use Application (CDUA) process were all designed to allow the university's use of the lands without causing excessive damage to the fragile environment. However, the university's focus on pursuing its own interest has led to conditions and practices that have countered or weakened these processes.
>
> Because the university focused on developing Mauna Kea, it did not allocate sufficient resources to protect other natural resources on the summit. Since 1967, the university focused on developing the summit for astronomical research, resulting in the construction of some of the most powerful astronomical instruments in the world. These telescopes enhanced the university's prestige and that of its astronomy program. However, this focus and effort overshadowed the university's commitment to provide reasonable assurance of protection for the summit's natural resources.

Exhibit F-23 at page 15.

418. The Auditor's Report further noted:

> The university was granted lands to meet its research needs, but it did not fulfill its obligations as a responsible leaseholder of conservation lands. Over the years, more than $600 million was spent to construct the 13 telescopes and the antenna on Mauna Kea. Another $50 million per year is spent by agencies involved in the operation of telescopes. A small percentage of these substantial amounts could reasonably have been used for environmental protection and to provide basic services to the public. However, this is not the case. The university claims that it lacks the funds and the positions to implement the protection controls outlined in its management plans. We found this largely the university's own fault. It took active steps to ensure that the development benefits would not be lost to other needs.

Exhibit F-23 at page 17.

419. The Auditor's Report also made the following findings:

> Historic preservation has been a concern since the signing of the 1968 general lease. . . . . While the concern for preservation previously existed, it was not addressed until the 1983 complex development master plan. However, the plan did not adequately address preservation.
>
> The cultural value of Mauna Kea is largely unrecognized.

Exhibit F-23 at pages 21, 23.

420. The Auditor's Report noted that the development of astronomical facilities dramatically increased when significant authority over the management and development of the summit was transferred from the university's administration to the Institute for Astronomy. Exhibit F-23 at page 16.

421. Subsequent to the publication of the Auditor's Report, management of the Mauna Kea Science Reserve was taken from the Institute of Astronomy and placed with the Office of Mauna Kea Management (OMKM). OMKM is funded as an ongoing program unit of the University of Hawai`i at Hilo, separate and apart from the Institute of Astronomy, which is a unit within the University of Hawai`i at Manoa. Kudritzki WTD at 13; McLaren WTD at 1; Stormont WDT at 2.

422. Among other things, OMKM has been developing programs in four areas: Hawaiian Culture, Astronomy Education, Environment, and Public Safety and Conduct. For each of these program areas, the MKMB has established functional committees comprised of members of MKMB and persons recognized in related fields. The purpose of the functional committees is to fashion programs in each area and to set priorities. Stormont WDT at 4-5.

423. OMKM, MKMB, and Kahu Ku Mauna are working with Bishop Museum to develop protocols for visits to Mauna Kea. The protocols are being developed based upon researching all available sources, including Bishop Museum archives, songs, and chants. Additionally, OMKM has contracted with Kepa Maly, a renown and respected ethnographer and cultural historian, to continue with an oral history project on Mauna Kea. Stormont WDT at 5-6.

424. OMKM has contracted with the Bishop Museum natural sciences department to conduct new Wekiu Bug surveys across a broader portion of the summit to more fully understand the range of the Wekiu Bug on Mauna Kea. The functional committee on the environment is interested in expanding the survey to include other arthropods, and to conduct the study on a more sustained basis in order to gather data on trends and not be limited to "snapshots" in time. Stormont WDT at 6; Stormont Tr. 2/12/03 at 187.

425. OMKM has developed a ranger program. The primary role of the rangers would be education, coordination, monitoring, and resource management. Rangers receive intensive training in Mauna Kea's cultural, natural, and scientific resources. The rangers must also attend a 40-hour First Responder course, courses in geographic information system ("GIS") and global positioning system ("GPS") technology, and a computer course. Stormont WDT at 6-7.

426. OMKM recognizes the need to balance issues such as protection of Mauna Kea and managing access to the summit. It plans to address such issues through adoption of administrative rules developed with public input. Stormont WDT at 7.

427. OMKM was created by the UH-Hilo Chancellor and is reliant upon funding from the legislature through the UH-Hilo's budget. Stormont WDT at 2; Stormont Tr. 2/12/03 at 190:21 – 191:2.

428. Members of the MKMB and the Kau Ku Mauna Council were selected on the basis of their knowledge, past involvement, and their willingness to commit to the process of managing the range of issues surrounding Mauna Kea. Each represents a particular community interest and are from all parts of the Island of Hawaii. Stormont WDT at 3.

429. Members of the MKMB were selected by the UH-Hilo Chancellor and approved by the Board of Regents. Stormont Tr. 2/12/03 at 225:24 – 226:1.

430. OMKM generally lacks authority over what occurs inside of any of the observatory facilities. Stormont Tr. 2/12/03 at 238:7 – 239:21.

## CONCLUSIONS OF LAW

### I. JURISDICTION AND PARTIES

1. The Board of Land and Natural Resources has jurisdiction over UH IfA's Conservation District Use Permit Application.

2. UH IfA, Sierra Club, Ching, Fergerstrom, MKAH, ROOK I and HIEDB have standing to appear in this contested case hearing as parties and are properly therefore before the Board.

### II. LEGAL FRAMEWORK

#### A. CONSTITUTIONAL AUTHORITY AND ADMINISTRATIVE RULES

1. Article XII, Section 1 of the Hawai‘i State Constitution provides: For the benefit of present and future generations, the State and its political subdivisions shall conserve and protect Hawai‘i's natural beauty and all natural resources, including land, water, air, minerals and energy sources, and shall promote the development and

utilization of these resources in a manner consistent with their conservation and in furtherance of the self-sufficiency for the State.

2. Article XII, Section 7 of the Hawai‘i State Constitution provides: The State reaffirms and shall protect all rights, customarily and traditionally exercised for subsistence, cultural, and religious purposes and possessed by ahupua‘a tenants who are descendants of native Hawaiians who inhabited the Hawaiian Islands prior to 1778, subject to the rights of the State to regulate such rights.

3. Article, XII, Sec 9 of the Hawai‘i State Constitution provides: “Each Person has the right to a clean and healthful environment, as defined bylaws relating to environmental quality, including control of pollution and, conservation, protection and enhancement of natural resources…(Emphasis added)

4. The conservation district is the most restrictive of the four land use classifications authorized under Hawaii’s Land Use Law, Hawai‘i Revised Statutes (“HRS”) Chapter 205. Conservation districts are defined to include:

> areas necessary for protecting watersheds and water sources; preserving scenic and historic areas; providing park lands, wilderness, and beach reserves; conserving indigenous or endemic plants, fish and wildlife, including those which are threatened or endangered; preventing floods and soil erosion; forestry; open space and areas whose existing openness, natural condition or present state of use, if retained, would enhance the present or potential value of abutting or surrounding communities, or would maintain or enhance the conservation of natural or scenic resources; areas of value for recreational purposes; other related activities; and other permitted uses not detrimental to a multiple use conservation concept. HRS § 205-2(e).

5. The Department of Land and Natural Resources (“DLNR”) administers public lands within the Conservation District pursuant to HRS Ch. 1 83C. That chapter makes the following statement of public policy:

> [t]he legislature finds that lands within the state land use conservation district contain important natural resources essential to the preservation of the State’s fragile natural ecosystems and the sustainability of the State’s water supply. It is therefore, the intent of the legislature to conserve, protect, and preserve the important natural resources of the State through appropriate management and use to promote their long-term sustainability and the public health, safety and welfare. HRS § 183C-1.

6. In evaluating the merits of a proposed use in the conservation district, the Board evaluates eight criteria found in Haw. Admin. Rules § 13-5-30(c). The eight criteria are:

a) The proposed land use is consistent with the purpose of the conservation district;

b) The proposed land use is consistent with the objectives of the subzone of the land on which the use will occur;

c) The proposed land use complies with provisions and guidelines contained in chapter 205A, Haw. Rev. Stat., entitled "Coastal Zone Management," where applicable;

d) The proposed land use will not cause substantial adverse impact to existing natural resources within the surrounding area, community or region;

e) The proposed land use, including buildings, structures and facilities, shall be compatible with the locality and surrounding areas, appropriate to the physical conditions and capabilities of the specific parcel or parcels;

f) The existing physical and environmental aspects of the land, such as natural beauty and open space characteristics, will be preserved or improved upon, whichever is applicable;

g) Subdivision of land will not be utilized to increase the intensity of land uses in the conservation district; and

h) The proposed land use will not be materially detrimental to the public health, safety and welfare.

7. The conservation district lands are categorized into subzones. The subzone in which the Outrigger Telescopes are proposed is the resource subzone. Resource subzones include lands necessary to ensure the sustained use of natural resources and include lands suitable for parks, outdoor recreational uses, and the like. Haw. Admin. Rules § 13-5-13.

8. Astronomy facilities under are an identified land use in the resource subzone. Haw. Admin. Rules § 13-5-24.

9. Astronomy facilities in the resource subzone require a board permit and an approved management plan. Haw. Admin. Rules § 13-5-24.

10. The burden of proof is on the UH IfA to prove that it meets the requirements for the granting of the application. The degree of proof is a preponderance of the evidence. Minute Order 13, filed November 15, 2003; Haw. Admin. Rules § 13-5-30(c); Haw. Rev. Stat. 91-10(5).

11. Any conclusion of law improperly designated as a dfinings of fact shall be deemed or construed as a conclusion of law. Any findings of fact improperly designated as a conclusion of law shall be deemed or construed as a findings of fact.

## B. CASELAW

1. In Public Access Shoreline Hawai‘i v. Hawai‘i County Planning Commission, 79 Hawai‘i 425, 903 P.2nd 1246 (1995), (hereafter "PASH"), the Hawai‘i Intermediate Court of Appeals stated:

> The State's power to regulate the exercise of customarily and traditionally exercised Hawaiian Rights, necessarily allows the State to permit development that interferes with such rights in certain circumstances… Nevertheless, the State is **obligated** to protect the reasonable exercise of customary and traditionally exercised rights of Hawaiians to the extent feasible.

2. In Ka pa‘akai O Ka ‘Aina v. Land Use Commission (hereafter "Ka Pa‘akai v. LUC"), 94 Hawai‘i 31, 47, 7 P.3d 1068, 1068 (2000), the Hawai‘i Supreme Courts states:

> To preserve and protect traditional and customary native Hawaiian rights, the Board examines the following factors:
>
> a. The identity and scope of cultural, historical, and natural resources in the application area, including the extent to which traditional and customary native rights are to have been exercised in the application area;
> b. The extent to which those resources, including traditional and customary native Hawaiian rights, will be affected or impaired by the proposed action; and
> c. The feasible action, if any to be taken to reasonably protect native Hawaiian rights if they are found to exist.

3. In State v. Hanapi, 89 Haw. 77 (1998), the Court ruled that a person claiming a PASH right has the burden of proving the existence of such a right.

## C. BOARD OF LAND AND NATURAL RESOURCES DECISIONS

1. The visual or any other impacts of any proposed project are site specific. BLNR has allowed under Haw. Admin. Rules chapter 13-5, land uses in the conservation districts in less urbanized areas and off ridgelines where the visual impacts were either not as great or where the impacts could be more easily mitigated. Findings of Fact, Conclusions of Law, Decision and Order, *In the Matter of Conservation District Use Application for Hawaiian Electric Company, Inc. to Construct a 138-kV Transmission Line at Wa‘ahila Ridge, Honolulu*, Hawai‘i, DLNR File No. OA-2801 ("Wa‘ahila Ridge Decision") at 65, fn. 17.

2. When considering visual impacts, the BLNR does not ignore any preexisting conditions in the area proposed for a use, regardless of whether those existing land uses predated the current regulatory scheme. Wa‘ahila Ridge Decision at 65-66, fn. 17.

3. BLNR also takes into consideration whether limited alternatives may outweigh the obvious visual or other impacts. Wa‘ahila Ridge Decision at 66., fn. 17 (discussing Zond windpower project, File No. MA-2902).

4. Where alternative sites for the project necessarily are limited by their nature, obvious visual or other impacts may be outweighed. Wa‘ahila Ridge Decision at 66, n. 17 (discussing Zond windpower project, File No. MA-2902).

5. BLNR may approve a project despite environmental impacts to the Conservation District Area with appropriate mitigation and conditions. *See Stop H-3 Ass’n v. State Dept. of Transportation*, 68 Haw. 163, 706 P.2d at 451. Structures and land uses which impact a public viewplane of a significant natural feature like a pu‘u or ridge should propose adequate mitigation or make some showing of the lack of reasonable and practicable alternatives. Wa‘ahila Ridge Decision at 64, fn. 13.

## III. CONCLUSIONS OF LAW

1. Prior to 1998, when the Auditor’s Report was published, the University of Hawaii’s management of the Mauna Kea Science Reserve was inadequate to ensure the protection of the natural resources within the reserve. Because the university focused on developing Mauna Kea, it did not allocate sufficient resources to protect other natural resources on the summit. The management plan did not adequately address historic preservation and the cultural value of Mauna Kea went largely unrecognized.

2. In 2000, the University of Hawaii established and funded the Office of Mauna Kea Management. Through OMKM, the University is beginning to address the management deficiencies that existed while management of the science reserve was under the Institute of Astronomy.

3. If continuance of the OMKM is assured and if OMKM’s powers and responsibilities are expanded, the management deficiencies identified in the Auditor’s Report will be adequately addressed for the protection of natural and cultural resources.

4. Cumulative impacts are the incremental environmental archaeological and cultural impacts of the action when added to the past, present or reasonable foreseeable future actions. Haw. Admin. Rules § 11-200-2

5. The cumulative impacts of the project which is the subject of the Conservation District Use Permit Application will be small and occur primarily during the construction phase of the Outrigger Telescope Project.

6. Views of Mauna Kea and views from the site of the Outrigger Telescopes will be impacted. The colors matched to the surrounding cinders, proper design and grading practices will minimize the visual impacts.

7. The impacts on Wēkiu bug habitat have been minimized by improved design and modification of the Outrigger Telescope project. The impacts can be further minimized by close monitoring by an entomologist and implementation of the Wēkiu bug Mitigation Plan.

8. Protection of the native Hawaiian practitioners' exercise of customary and traditional practices on the summit area of Mauna Kea and within the area covered by the Application for the Conservation District Use permit can be accomplished through implementation of the following conditions:

a) Establishment of a program by which all persons involved in the construction, installation, and operation of the outrigger telescopes will be educated about the cultural and historical significance of the Mauna Kea summit area and trained in respectful and sensitive behavior while on the summit area.

b) Employment of a full-time archaeologist during the construction of the Outrigger Telescopes who shall be onsite during construction to insure minimal disturbance to any native Hawaiian cultural sites, practices and access to historical and cultural resources.

9. The protection of the natural resources of the Mauna Kea summit and the area covered by the application for the Conservation District Use Permit, can be accomplished through implementation of the following conditions:

a) Establishment of a program by which all persons involved in the construction, installation, and operation of the outrigger telescopes will be educated about the environment, ecology, and natural resources of the Mauna Kea summit area and trained in appropriate behavior while on the summit area for the protection of natural resources.

b) All construction materials, equipment, crates, and containers and packing materials shall be inspected by a full-time entomologist/biologist to assure no invasive plants or animals are introduced to the Mauna Kea summit areas and to ensure minimal disturbance to the Wekiu bug habitat.

c) Employment of a construction monitor to monitor compliance with the terms and conditions of the conservation district use permit as related to construction activities.

10. The Wēkiu Bug Mitigation Plan, the Wēkiu Bug Monitoring Plan, the Section 106 MOA, the Construction Best Management Practices Plan and all other existing plans and agreements designed to protect the natural resources of the Mauna Kea summit shall be complied with by the permitee.

11. Provided that the special conditions discussed above and as set forth below, and the standard conditions set forth in Haw. Admin. Rules § 13-5-42, as modified below, are imposed:

(1) The proposed land use will be consistent with the purpose of the conservation district;

(2) The proposed land use will be consistent with the objectives of the resource subzone;

(3) The proposed land use will not cause substantial adverse impact to existing natural resources within the surrounding area, community, or region;

(4) The proposed land use, including buildings, structures, and facilities, will be compatible with the locality and surrounding areas, appropriate to the physical conditions and capabilities of the specific parcel;

(5) The existing physical and environmental aspects of the land will be reasonably preserved; and

(6) The proposed land use will not be materially detrimental to the public health, safety, and welfare.

12. By separate order issued this day, the Board approves a management plan for the project.

13. Therefore, the proposed land use meets the criteria for issuance of a conservation district use permit. The proposed land use also reasonably protects identified Native Hawaiian rights.

**DECISION AND ORDER**

Based on the foregoing, the CDUA is GRANTED, and a conservation district use permit is issued subject to the following conditions.

(Unless otherwise explicitly indicated or clear from the context, "Board" shall mean the Board of Land and Natural Resources; "Chairperson" shall mean the Chairperson of the Board of Land and Natural Resources; and "Department" shall mean the Department of Land and Natural Resources.)

STANDARD CONDITIONS (MODIFIED)

1. The Permittee shall comply with all applicable statutes, ordinances, rules, and regulations of the federal, state, and county governments, and applicable parts of Hawaii Administrative Rules chapter 13-5.

2. The Permittee and its successors and assigns shall indemnify and hold the State of Hawaii harmless from and against any loss, liability, claim, or demand for property damage, personal injury, or death arising out of any act or omission of the Permittee, its successors, assigns, officers, employees, contractors, and agents under this permit or relating to or connected with the granting of this permit; provided, however, that

this condition shall be waived if the Permittee is an agency or instrumentality of the State of Hawaii.

3. The Permittee shall obtain appropriate authorization from the Department for the occupancy of state lands, if applicable.

4. The Permittee shall comply with all applicable State Department of Health administrative rules.

5. The Permittee shall provide documentation (e.g., book and page or document number) that the permit approval has been recorded in the Bureau of Conveyances of the Land Court, prior to submission for approval of subsequent construction plans.

6. Before proceeding with any work authorized by the Board or Department, the Permittee shall submit four (4) copies of the construction plans and specifications to the Chairperson or the Chairperson's authorized representative for approval for consistency with the conditions of the permit, the declarations set forth in the permit applications, and the findings of fact, conclusions of law, and decision and order in this case. Three (3) copies will be returned to the Permittee. Plan approval by the Chairperson shall not constitute approval required from any other agency.

7. Any work or construction to be done on the land shall be initiated within two (2) years of issuance of this permit, in accordance with construction plans that have been signed by the Chairperson, and, unless otherwise authorized, shall be completed within five years of the date of issuance of this permit. The Permittee shall notify the Department in writing when construction activity is initiated and when it is completed.

8. All representations relative to mitigation set forth in the accepted environmental assessment or environmental impact states for the proposed use, except as modified by the Decision and Order, are incorporated as conditions of this permit.

9. The Permittee understands and agrees that the permit does not convey any vested right(s) or exclusive privileges.

10. In issuing this permit, the Board has relied on the information and data that was provided in connection with the permit application, including, but not limited to, information and data obtained in the contested case proceeding. If, subsequent to the issuance of the permit, such information and data prove to be false, incomplete, or inaccurate, this permit may be modified, suspended, or revoked, in whole or in part, and the Board or Department may, in addition, institute legal proceedings.

11. When provided or required, potable water supply and sanitation facilities shall have the approval of the State Department of Health and the County Board of Water Supply.

12. Whenever required, the Permittee shall make provisions for access, parking, drainage, fire protection, safety, signs, lighting, and changes on the landscape.

13. Where any interference, nuisance, or harm may be caused, or hazard established by, the use, the Permittee shall be required to take measures to minimize or eliminate the interference, nuisance, harm, or hazard.

14. Obstruction of public roads, trails, and pathways shall be minimized. If obstruction is unavoidable, the Permittee shall provide roads, trails, or pathways acceptable to the Department.

15. Except as related to public highways, access roads shall be limited to a maximum of two (2) lanes.

16. During construction, appropriate mitigation measures shall be implemented to minimize impacts to off-site roadways, utilities, and public facilities.

17. If there were pre-existing floral species, cleared areas shall be re-vegetated within thirty (30) days, unless otherwise provided for in a plan on file with, and approved by, the Department.

18. Where applicable, use of the area shall conform to the program of the appropriate soil and water conservation district or plan on file with, and approved by, the Department.

19. The Chairperson may prescribe other terms and conditions.

20. If there is any conflict between the provisions of the Special Conditions and of the Standard Conditions (Modified), the Special Conditions shall control.

21. Failure to comply with any of the Standard Conditions (Modified) or the Special Conditions shall be grounds for modification or revocation of this permit, imposition of fines, and any other enforcement action authorized by law.

SPECIAL CONDITIONS

1. There shall continue to be an Office of Mauna Kea Management and a Mauna Kea Management Board, whose mission shall continue to be:

> Achieve harmony, balance and trust in the sustainable management and stewardship of the Mauna Kea Science Reserve through community involvement and programs that protect, preserve and enhance the natural, cultural and recreational resources of Mauna Kea while providing a world-class center dedicated to education, research and astronomy.

The Mauna Kea Management Board shall include, but not be limited to, a representative of the Department, Native Hawaiian interests, environmental interests, and the business community. The Office of Mauna Kea Management shall regularly consult with and seek advice from Native Hawaiians, Native Hawaiian organizations, and environmental organizations.

2. The Office of Mauna Kea Management shall oversee compliance with all terms and conditions of this permit and report any known or suspected non-compliance or violations to the Department.

3. On June 30 of each year that this permit is in effect, the Office of Mauna Kea Management shall submit to the Board of Land and Natural Resources a written report detailing its activities generally, and with particularity its activities with respect to its responsibilities under this permit.

4. All persons involved with the construction and installation of the outrigger telescopes, including, but not limited to, the construction manager, contractors, supervisors, and all construction workers, and all persons involved in the operation and maintenance of the outrigger telescopes, including, but not limited to, scientists and support staff, shall be educated about the historical and cultural significance of the Mauna Kea summit area, and shall be given training as to what constitutes respectful and sensitive behavior while on the summit area. A detailed plan for complying with this condition (including both the content of training and the procedures for implementation, including, but not limited to, a means for certifying persons who have completed the training program) shall be developed by the Office of Mauna Kea Management following consultation with Kahu Ku Mauna or other Native Hawaiians or native Hawaiian organizations known to have cultural ties to Mauna Kea, and reviewed and approved by the Department. A specialist or specialists in the field of Native Hawaiian culture shall be selected by the Office of Mauna Kea Management with the concurrence of the Department for the purpose of implementing the compliance plan, including, but not limited to, the conduct of educational and training programs for all persons described in this condition. To be qualified for appointment to this position(s), a person shall have worked as a Native Hawaiian cultural specialist and shall be knowledgeable of the types of cultural resources and practices relating to the summit of Mauna Kea.

5. All persons involved with the construction and installation of the outrigger telescopes, including, but not limited to, the construction manager, contractors, supervisors, and all construction workers, and all persons involved in the operation and maintenance of the outrigger telescopes, including, but not limited to, scientists and support staff, shall be educated about the environment, ecology and natural resources of the Mauna Kea summit area, and shall be given training as to what constitutes appropriate behavior while on the summit area for the protection of the natural resources. A detailed plan for complying with this condition (including both the content of training

and the procedures for implementation including, but not limited to, a means for certifying persons who have completed the training program) shall be developed by the Office of Mauna Kea Management following consultation with scientists and environmental organizations knowledgeable about the Mauna Kea summit area, and reviewed and approved by the Department.

6. During all periods of construction (including, but not limited to, the delivery of construction materials to the site or to staging areas), there shall be on-site a construction monitor, whose responsibility shall be to monitor compliance with the terms and conditions of this permit as related to construction activities. (Note that General Condition #1 requires compliance with all applicable statutes, ordinances, rules and regulations of the federal, state, and county governments and applicable parts of Hawaii Administrative Rules chapter 13-5.)

   The on-site construction monitor shall have the authority to order that any or all construction activity under this permit cease if and when, in the construction monitor's judgment, (a) there has been a violation of the terms or conditions of this permit that warrants cessation of construction activities, or (b) that continued construction activity will unduly harm natural or cultural resources; provided that the construction monitor's order to cease construction activities shall be for a period not to exceed seventy-two (72) hours for each incident. All orders to cease construction issued by the construction monitor shall be immediately reported to the Chairperson and the Office of Mauna Kea Management. The Chairperson may issue a cease and desist order to extend the period of time that construction activity is prohibited, or such other order as the Chairperson deems appropriate.

   The construction monitor shall be selected by the Office of Mauna Kea Management with the concurrence of the Department. The construction monitor shall have experience and be knowledgeable in construction management. Prior to assuming on-site duties, the construction monitor shall have completed the educational and training programs as provided in Special Conditions #4 and #5.

7. Prior to entry into the Mauna Kea science reserve, all construction materials, equipment, crates, and containers carrying materials and equipment shall be inspected by a trained biologist, selected by the Office of Mauna Kea Management and approved by the Department, who shall certify that all materials, equipment, and containers are free of any and all flora and fauna that may potentially have an impact on the Mauna Kea summit ecosystem.

8. Whenever construction activities include earth movement or disturbance, a trained entomologist, selected by the Office of Mauna Kea Management and approved by the Department, shall be on site to monitor any impacts, real or potential, of construction activity on the Wekiu bug.

9. The Permittee shall implement the Wekiu Bug Mitigation Plan, dated December 14, 2001; provided that monitoring of Wekiu bug populations shall continue for no less than five (5) years following completion of construction of the outrigger telescopes. Additionally, Permittee shall make efforts to reduce the field study mortality rate of Wekiu bugs to less than forty percent (40%). Progress reports on the Wekiu Bug mitigation plan, efforts to reduce the field study mortality rate, and monitoring results shall be submitted bi-annually to the Department of Land and Natural Resources, the Office of Mauna Kea Management, and the Bishop Museum. The Board reserves the right to modify the Wekiu Bug mitigation plan if, upon advice and recommendation of trained entomologists, the Board determines that the mitigation plan is not, or will not be, successful in protecting and preserving the Wekiu Bug.

10. Whenever construction activities include earth movement or disturbance, a trained archaeologist, selected by the Office of Mauna Kea Management and approved by the Department, shall be on site to monitor any impacts, real or potential, of construction activity on archaeological and historical resources.

11. Notwithstanding any provision of Hawaii Revised Statutes chapter 6E to the contrary, if an inadvertent discovery of any human burial is discovered in the course of construction of the project, the Permittee shall seek the advice and recommendation of either the Hawaii Island Burial Council or a recognized Native Hawaiian group selected by the Office of Mauna Kea Management for treatment of the inadvertently discovered burial.

12. Except for Wekiu Bug habitat restoration, and for the placement of excess excavated cinder not required for backfill or habitat restoration, this permit does not authorize any grading or other earth movement outside of the area subleased to Caltech. Excess excavated cinder may be place outside the subleased area and within the Science Reserve after consultation with the State Historic Preservation Division and with the prior approval of the Office of Mauna Kea Management and the Department. Use of areas within the Science Reserve but outside of the area subleased to Caltech as construction staging or storage areas shall be confined to areas already developed or improved; provided that the use of such area shall be coordinated with, and shall require the prior approval of, the Office of Mauna Kea Management and the Department.

13. The Permittee shall periodically, but no less than once annually, in writing, remind operators of observatory facilities that violation of permit conditions may result in permit cancellation and closure of facilities by the Board.

14. Within two (2) years from the date of issuance of this permit, the Office of Mauna Kea Management, with consultation with interested Native Hawaiian individuals and

organizations, shall develop a comprehensive and integrated resource management plan for the purposes of:

(a) identifying important cultural and environmental resources within the summit area, beyond the project site boundaries, and other locations on Mauna Kea that may be determined to be appropriate for such plan; and

(b) providing a plan for the proper protection and management of such resources and the responsible public and private use of the summit, consistent with the protection of such resources.

15. To the extent not in conflict with the terms and conditions of this permit, the Permittee shall comply with the Memorandum of Agreement Under the National Historic Preservation Act Among the National Aeronautics and Space Administration, The Advisory Council on Historic Preservation, the Hawaii State Historic Preservation Officer, the University of Hawaii, the California Association for Research in Astronomy, and the California Institute of Technology Regarding the Outrigger Telescopes Project, Mauna Kea, Hawaii. Compliance with this MOA shall not nullify any requirements or excuse any performance under this permit.

16. The Permittee shall comply with the Keck Interferometer Outrigger Telescopes Construction Best Management Practices Plan, Draft Revision A, January 23, 2002 (BMP). Any revisions to the BMP shall require the approval of the Office of Mauna Kea Management and the Department.

17. Upon termination of this permit, by abandonment of the use of the outrigger telescopes, revocation, or otherwise, Permittee shall dismantle and remove all facilities authorized under this permit, all in accordance with plans approved by the Department.

18. Each year, on the anniversary date of the issuance of this permit, for so long as this permit is in effect, the Permittee shall submit to the Board a status report detailing the status of the project and compliance efforts relating to each of the terms and conditions of this permit.

(The foregoing findings of fact, conclusions of law, and decision and order may be signed in counterparts.)

DATED: Honolulu, Hawaii, _____, 2004.

_____
Peter T. Young,
Chairperson

_____
Timothy E. Johns
Member

_____
Kathryn Whang Inouye
Member

_____
Ted K. Yamamura
Member

_____
Toby M. Martyn
Member

_____
Ron Agor
Member

BOARD OF LAND AND NATURAL RESOURCES

STATE OF HAWAI‘I

| | | |
|---|---|---|
| In the Matter of Conservation District Use Application for<br><br>UNIVERSITY OF HAWAI`I INSTITUTE FOR ASTRONOMY<br><br>to construct and operate six 1.8-meter Outrigger Telescopes (CDUP application HA-3065) within the summit area of the Mauna Kea Science Reserve, District of Hāmākua, Island of Hawai`i | ) | DLNR File No. HA-02-06<br><br>CERTIFICATE OF SERVICE |

CERTIFICATE OF SERVICE

The undersigned hereby certifies that a true and correct copy of the foregoing document was duly served on this date on the following party by United States mail, postage prepaid:

Lisa W. Munger, Esq.
Goodsill, Anderson, Quinn & Stifle
1099 Alakea Street, Suite 1800
Honolulu, Hawai‘i 96813
Attorney for University of Hawai‘i,
Institute for Astronomy

Nelson Ho, Chairman
Sierra Club, Hawai‘i Chapter
Chapter Conservation Committee
32 Kahoa Street
Hilo, Hawai‘i 96720-2206

Clarence Ching
P.0. Box 6916
Kamuela, Hawai‘i 96743

Harry Fergerstrom
13-1339 Leilani Avenue
Pahoa, Hawai‘i 96778

Michael Moore, Esq.
Tsukazaki, Yeh & Moore
85 West Lanikaula Street
Hilo, Hawai‘i 96720
Attorney for Hawai‘i Island
Economic Development Board, Inc.

Royal Order of Kamehameha I,
Moku o Mamalahoa, Heiau Helu Tlua
1162 Kalanianaole Avenue
Hilo, Hawai‘i 96720

Mauna Kea Anaina Hou
230 Lymon Avenue
Hilo, Hawai‘i 96720

DATED: Honolulu, Hawai‘i; _____, 2004.

_____
DAWN HEGGER